JULY 1957

GAS

BOSTON DEVELOPS NEW TECHNIQUE FOR CONVERSION

A CHILTON PUBLICATION

ENGINEERING • UTILIZATION • PIPELINES • MANAGEMENT

WHAT IS THE FUTURE OF PLASTICS FOR GAS METERS?

Read about it in the

ROCKWELL GAS REPORT

Rockwell Products

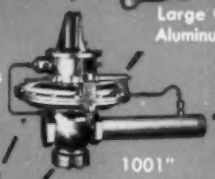
Large Capacity Pressed Steel Meters

Domestic Size Aluminum Meters

Tin Meters

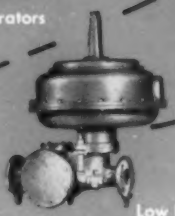
Large Capacity Aluminum Meters

Nordstrom Standard Valves

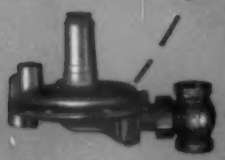

1001" Regulators

Nordstrom Hypreseal Valves

Chart Integrators


Low Pressure Distribution Regulators

Industrial Regulators


Service Regulators

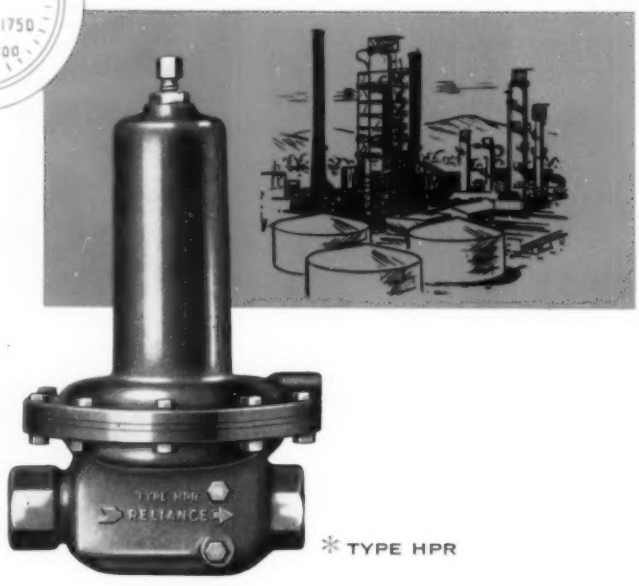
Nordstrom Service Cocks

High Pressure Distribution Regulators

Orifice Meters

The Rockwell Gas Report is edited and produced for the operating group of the gas industry by Rockwell Manufacturing Company, Pittsburgh 8, Pa.

TURN TO PAGES 19 TO 22 IN THIS ISSUE



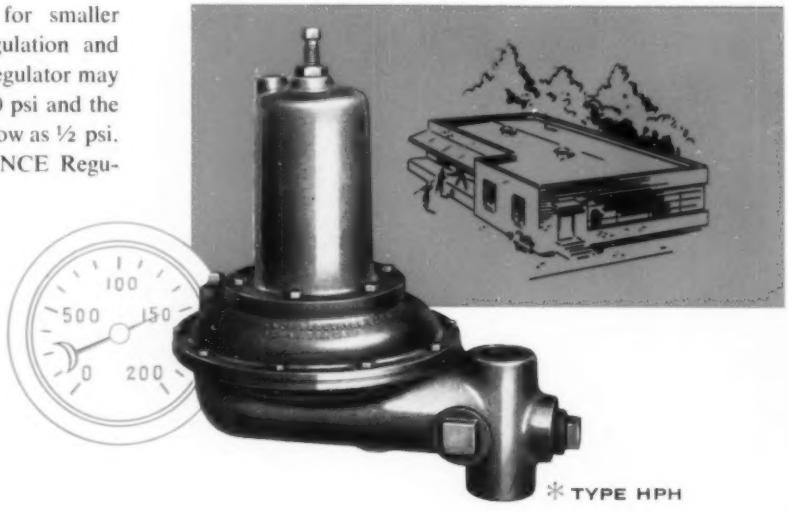
* TYPE HPR

These two RELIANCE High-Pressure Gas Regulators are used by several different industries. From the largest refinery to small industrial plants, they are always on the job, reducing high gas pressures to a low, steady flow of gas that can be utilized to the best advantage.

TYPE **HPR*** is available in several models which allow inlet pressures up to 1000 psi (2000 psi in bronze) and reduce them to as low as 2½ psi. This wide pressure range, plus compact, rugged construction, make this Regulator a natural for farm taps, general gasoline plant and refinery installation, and for controlling any high pressure gases.

Silent Masters OF HIGH PRESSURE GAS

TYPE **HPH*** is recommended for smaller industrial plants where sensitive regulation and positive lock-up are required. This Regulator may be used with inlet pressures up to 150 psi and the outlet pressures may be reduced to as low as ½ psi. *Throughout general industry* RELIANCE Regulators MAKE GAS BEHAVE.



* TYPE HPH

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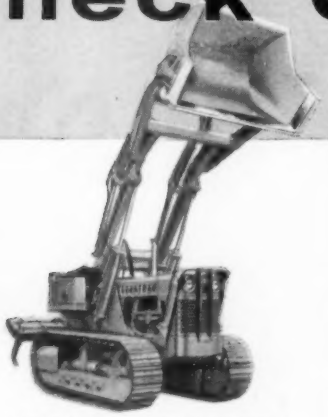
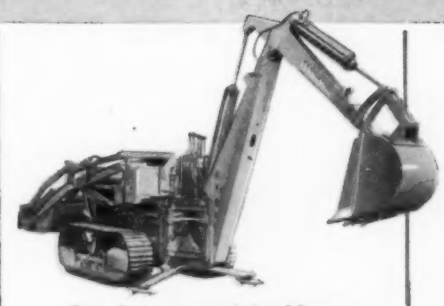


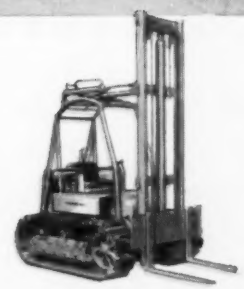
Crawler-mounted loaders

Five sizes — ½ to 2-cu yd. — with exclusive "knock-out" dumping action, plus improved bucket rollback. Extra-high dump clearance simplifies loading high trucks and hoppers.



Crawler-mounted backhoes

Exceptional power and stability for tough digging in hard ground, steep grades, etc. Digs 12½' below grade. Available with various dipper sizes and optional front-end loader or dozer.

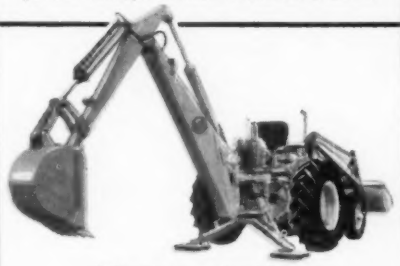


Crawler fork lift

Keeps jobs moving in any weather or terrain. Unloads trucks . . . carries, lifts materials to 21'4" height. Mounts quick-change loader, dozer, concrete bucket, log-grab, or crane hook.

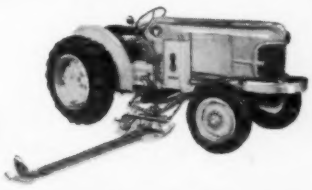
Wheel-type loaders

Beats any ½-yd. loader you ever saw for light loading, backfill and clean-up. 100% Case-engineered, Case-built, with heavy-duty lift-arms and automatic power-leveling.



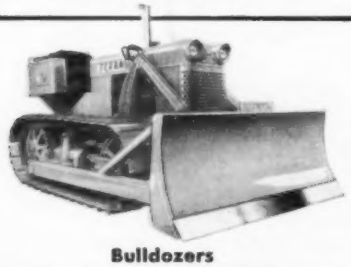
Wheel-type backhoes

Lowest-priced combination backhoe-loader on the market. Heavy-duty industrial design, with hydraulic foot-controlled 180° swing, telescoping stabilizers, many other advanced features.



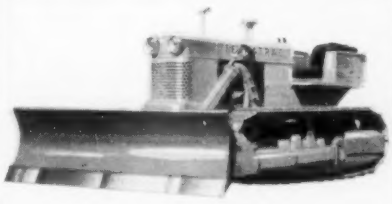
Rubber-tired prime-movers

Three economical sizes — 42, 60 and 100 HP —with high-torque Case engine for operating mower, grader blade, etc. Also ideal for miscellaneous winching and drawbar work.



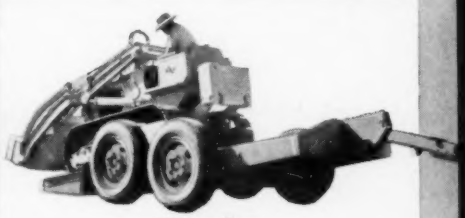
Bulldozers

Seven low-cost models under 80 HP — four with torque converters — plus larger sizes up to 100 HP, with max. 24,000 lbs. drawbar pull. Largest models feature optional "power-tilt."



Angledozers

Eleven gasoline and diesel-powered models from 42 to 100 HP. Largest models have torque-converter drive, instant power-shift, power steering—plus exclusive "power-angling" blade.



Tilt-trailers

4 or 8-ton capacity. Easily loaded or unloaded by one man. Available at saving of $500 to $1000 under competitive trailer prices with purchase of new TerraTrac crawler.

Maybe you didn't realize it . . . but J. I. Case Company now builds the *most advanced* line of industrial tractors and equipment of any single manufacturer in the 40 to 100 HP range. You can choose from a complete family of new Case-built prime-movers — *both wheel-type and crawlers* — plus a full line of matching loaders, bulldozers, backhoes, fork lifts and trailers. There's a rig for every need and budget — with just *one warranty, one service source, one easy financing arrangement,* on each complete machine. See your nearest Case Industrial Dealer for full details.

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☐ Wheel loaders ☐ Wheel-type backhoes ☐ Rubber-tired prime-movers ☐ Bulldozers ☐ Angledozers ☐ Tilt-trailers

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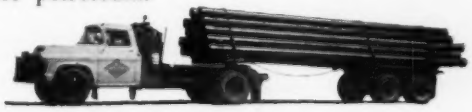
"..thinks a female connection is a steady date."

The oil country has a whopping big appetite for pipe. Lone Star Steel's huge plant was built for the specific purpose of supplying fully normalized *API casing, tubing and line pipe* to Joe Roughneck, heart of the oil and gas industry. As fast as we can make it, he gets it!

Now . . . we're building again . . . our new stretch-reducing mill and another open hearth furnace. Goal: more fine steel and more pipe . . . to help Joe meet the greater domestic and export demand for petroleum.



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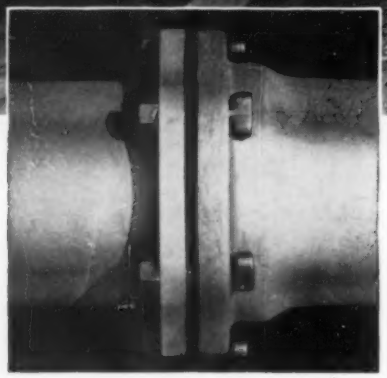

Chicago, Ill. 30" mechanical joint Cast Iron pipe for natural gas distribution system in downtown Chicago.

CAST IRON

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

MECHANICAL JOINT **cast iron**

MONEY AFTER A HUNDRED YEARS!

For long term economy use Cast Iron Pipe

Cast iron distribution mains with a century and more of continuous service are common in the gas industry.

40 American companies have them. Cast iron mains with 50 years and more of service are numbered in the hundreds.

That's dependability. Built in! And today, *modernized* cast iron pipe, centrifugally cast, is even more efficient. Standardized mechanical joints are bottle-tight under all distribution gas pressures . . . and for all types of gas. Wall thicknesses are uniform. Joint design allows deflection during and after installation. Service lengths and ample variety of standard fittings cut time and labor in congested undergrounds.

Add availability. Periodic shortages never hamper your installation plans.

Your choice of cast iron pipe is a wise one. A hundred years of proof back it!

Laid in 1823, this cast iron gas main is still serving the Boston area efficiently.

This outstanding service is typical of cast iron pipe. Moreover, *modernized* cast iron pipe is even tougher—promises even longer life.

A FEW OF THE 40 GAS UTILITIES WITH CENTURY-OLD CAST IRON MAINS IN SERVICE

Peoples Gas Light and Coke Co., Chicago—Baltimore Gas and Electric Co.—Philadelphia Gas Works—Richmond Gas Works, Richmond, Va.—Hartford Gas Company, Hartford, Conn.

pipe FOR MODERN GAS DISTRIBUTION

GAS Thermally Thinking

THE impact of Trans-Canada Pipe Line's new gas system is reverberating throughout the North American gas industry. The project is vital to the continued boom in Canada and it directly affects gas supply on an international basis.

It is well to study the movement of natural gas about the North American continent. In doing this, however, the practical approach is to forget about proposed volumes or certificated volumes of gas. The statistics we have now will mean little to the overall, long-range view. Of greater importance is interconnection of physical facilities; the fact that Mexico, United States, and Canada can let a valuable commodity pass rather freely across borders; and the potential of interchanging natural gas resources among the North American community of nations.

The Westcoast Transmission natural gas pipeline can pick up natural gas from huge reserves in Peace River fields of British Columbia and Alberta, Canada. This gas can be delivered to the United States via the Pacific Northwest Pipeline Corp.'s system. Thus the U. S. Pacific Northwest can (and will) be served with Canadian gas. And Pacific Northwest's system could in theory deliver to El Paso Natural's system—there is some physical connection in existence. So Canadian gas can (and probably will) be delivered to New Mexico, Arizona, Nevada and, most important, California markets.

Conversely, California natural gas could be delivered to Canada —perish the thought—with some rearrangement of facilities. To return to reality, filings have been made to beef-up the Chicago area gas supply with additional volumes that could follow the path: Pacific Northwest pipeline; which sells to Colorado Interstate; which wants to sell the Natural Gas Pipeline Co. of America; which does sell to Peoples Gas and others in the Chicago area. And Westcoast Transmission does sell to Pacific Northwest, so if the "wants" part of the propositions are satisfied, Canadian gas could be sent to Chicago. Or, with a little imagination, Texas and/or California natural gas could take the El Paso-Pacific Northwest-Colorado Interstate-Natural Gas Pipe route to Chicago.

Should FPC approve the Trans-Canada-Midwestern-Tennessee plans in full, Canadian gas from Alberta will flow to markets in midwestern U. S. and to U. S. markets on the East Coast.

The important thing is that gas companies are growing closer together physically. Inter-connections are becoming more numerous. Right now, pipe sizes and designed direction of flow would prevent some of the theoretical flow of gas mentioned. But in 10, 15 or 20 years system sizes will have changed — grown. Reversal of system flow is relatively—very relatively—simple. And you can hang your hat on the fact that the gas reserves and supply picture in 20 years is certainly going to be different.

So, damn the politics, national passions and geography. The economic growth of North America demands ever more energy. North American natural gas resources will be brought to the demand wherever the twain shall be.

J. Fred Ebdon

EDITOR

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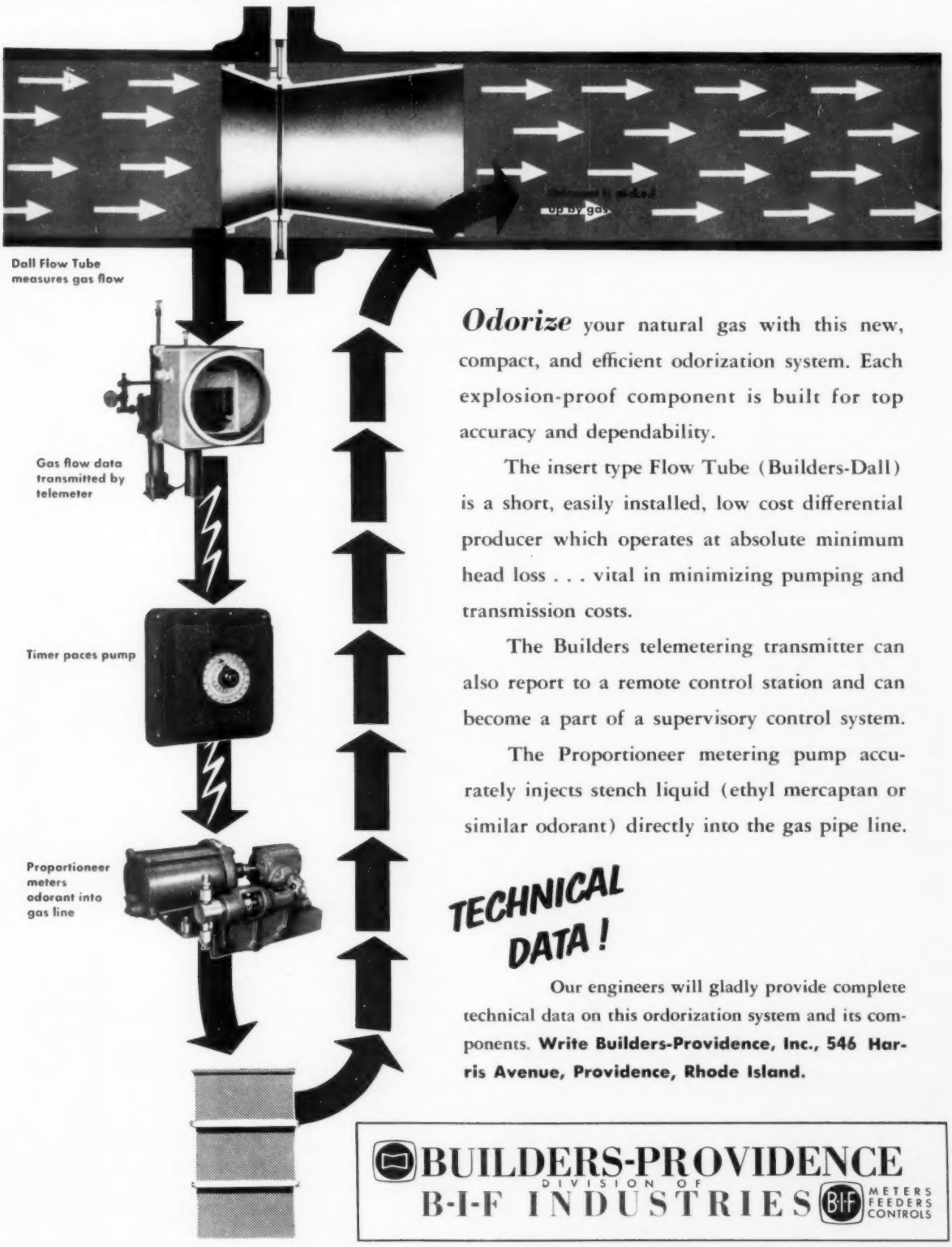
Odorize MORE ECONOMICALLY!!


Dall Flow Tube measures gas flow
Gas flow data transmitted by telemeter
Timer paces pump
Proportioneer meters odorant into gas line

Odorize your natural gas with this new, compact, and efficient odorization system. Each explosion-proof component is built for top accuracy and dependability.

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The Builders telemetering transmitter can also report to a remote control station and can become a part of a supervisory control system.

The Proportioneer metering pump accurately injects stench liquid (ethyl mercaptan or similar odorant) directly into the gas pipe line.

TECHNICAL DATA!

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GAS highlights

SPOT NEWS, TRENDS, COMMENT ON GAS INDUSTRY AFFAIRS

JULY 1957

President Eisenhower's willingness to accept the Harris-O'Hara gas bill without the two amendments proposed earlier will bring wavering supporters back to the fold. But it probably won't stir up any new opposition. President Eisenhower's statements removing the amendments as Administration demands came in a letter to Rep. Oren Harris (D.-Ark.), chairman of the House Commerce Committee and cosponsor of the bill, only a few days after he strongly endorsed the bill at a press conference. His letter to Representative Harris said in part:

"As I have repeatedly stated, I favor legislation freeing producers of natural gas from utility-type regulation. The amendments referred to were offered as of possible desirability, but do not represent my fixed conclusions. Your committee will doubtless wish to consider them with this thought in mind. Whether or not they are adopted, I wish to re-emphasize the importance of enacting natural gas legislation at this session of Congress."

Houston Natural Gas Corp. has agreed to buy all of the oil and gas properties formerly owned by McCarthy Oil and Gas Corp., Houston Natural President John H. Wimberly has announced. The properties were purchased from Equitable Life Assurance Society of the United States. Cash and production payments will total $7 million. Included in the transaction were Equitable's net interest of 17,000 acres, 10,000 of which are producing. The properties include substantial oil and gas reserves in the Big Hill and Stowell fields in Jefferson county, Texas. The properties will be owned and operated by Houston Natural Gas Production Co., Houston Natural subsidiary.

Tennessee Gas Transmission Corp.'s plan to tap a big natural gas field in the Gulf of Mexico is being scrutinized again by the Federal Power Commission. The plan had been okayed by FPC with the proviso that the suppliers, known as the CATCO group, would agree to decrease the gas price. TGT applied for a rehearing on the case when the suppliers refused to go along with the FPC order. CATCO had offered to sell gas to TGT for 21.4 cents/Mcf. FPC authorized a price of 17 cents/Mcf, but left the door open for producers to charge the higher rate subject to refund while a full cost study of the rate schedule was underway. TGT told the commission that the producers refuse to lower the starting price, and now want to cancel their supply contract. The CATCO group holds leases on 95,000 acres of submerged lands with estimated reserves of at least 1.7 MMcf.

A move to increase the Louisiana gas gathering tax 1.5 cents per thousand cu ft has gained the backing of the state's teachers association. The teachers group is urging the state legislature to add 1.5 cents/Mcf to the present 1 cent/Mcf tax. The proposed increase would be used to increase teachers' pay schedules throughout the state. The association also urged Governor Long to call a special session this month to consider the new tax proposal. A similar tax rate increase was defeated in the state legislature this last year.

Internal coatings figure prominently in Transcontinental Gas Pipe Line Corp.'s construction plans for 1957. Raymond H. Crowe, Transco's chief engineer, reported at the recent AGA Production Conference in Miami Beach that the company will internally coat between 150 and 200 miles of new 24-, 30-, and 36-in. pipe this year. The Houston-headquartered pipeline company has been pioneering internal coating of big inch transmission lines, and had 268 miles of internally coated line in operation at the start of the year. Mr. Crowe said that Transco still considers its internal coating work as experimental, and said that tests on increased efficiency are still being conducted.

Pipeliners will start work in July on the line that will bring natural gas to the gas industry's last undeveloped frontier. Houston Texas Gas & Oil Corp. will start work on its section of the 1518-mile pipeline that will bring natural gas from Texas to Florida at a point east of the Mississippi river and north of Baton Rouge in Louisiana. Houston will build 942 miles of 24- and 18-in. line to a terminus point near Miami, Fla. The line will be supplied with natural gas provided by Coastal Transmission Corp., which will deliver to Houston through a soon-to-be-built 574-mile mainline running from the production fields of Texas to the delivery point near Baton Rouge.

T. T. Arden has been elected president of Robertshaw-Fulton Controls Co. John A. Robertshaw, former president, moves up to chairman of the board. Mr. Arden has been executive vice president of the company since 1947, and was in charge of the western operations. He is currently president of the Pacific Coast Gas Association.

W. M. Elmer is the new president of Texas Gas Transmission Corp., succeeding the late W. T. Stevenson. Mr. Elmer has been executive vice president and a director of Texas Gas since 1955, and has been president of the subsidiary Texas Gas Exploration Corp. since 1953.

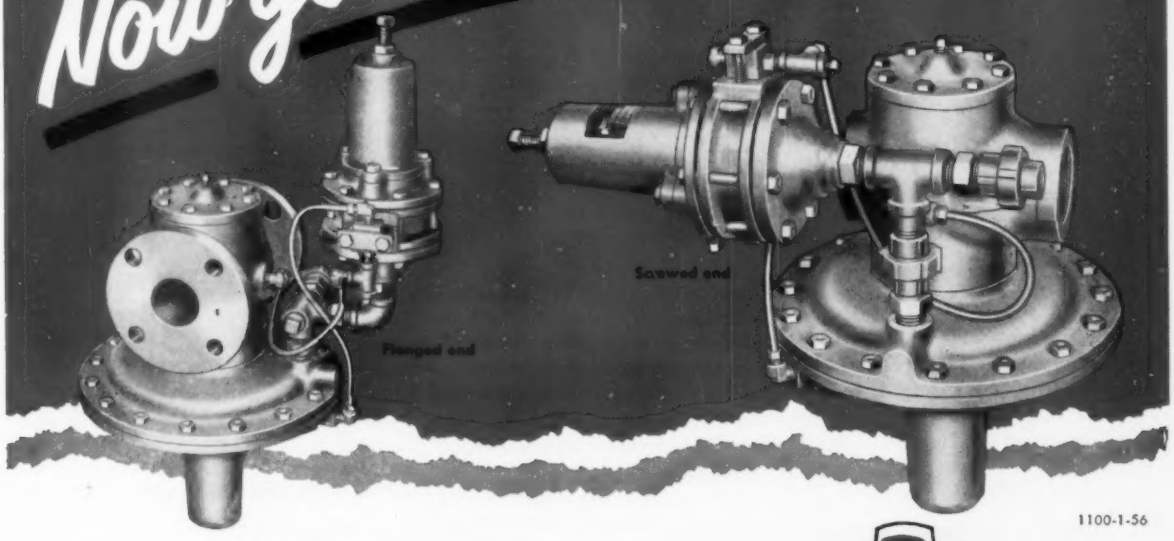
LINE PRESSURE GOING UP!

MEMO
FROM THE OFFICE OF THE PRESIDENT

Geo:— Considering raising line pressure Better check this— Now good up to 400 psi Rehm.

Chaplin-Fulton '1100' REGULATOR

Now good up to 400 psi



1100-1-56

Now, more versatile than ever—good up to 400 psi. Your choice of three body assemblies—

2" flanged 250 lb.	rated for 400 psi
2" screwed end	rated for 400 psi
2" flanged 125 lb.	rated for 175 psi

All suitable for outlet pressure range from ounces to 150 psi with no change required in regulator or pilot—just change the pilot spring. It's accurate—versatile—compact! A good buy!

Why stock two, when Model '1100' will do?

And, if 400 psi is too low, why not try the all-steel Model '1200', good up to 1200 psi inlet and 600 psi outlet?

Full information on request.

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MANUFACTURING COMPANY
Pittsburgh 25, Pennsylvania

30 years of progress with the Natural gas industry

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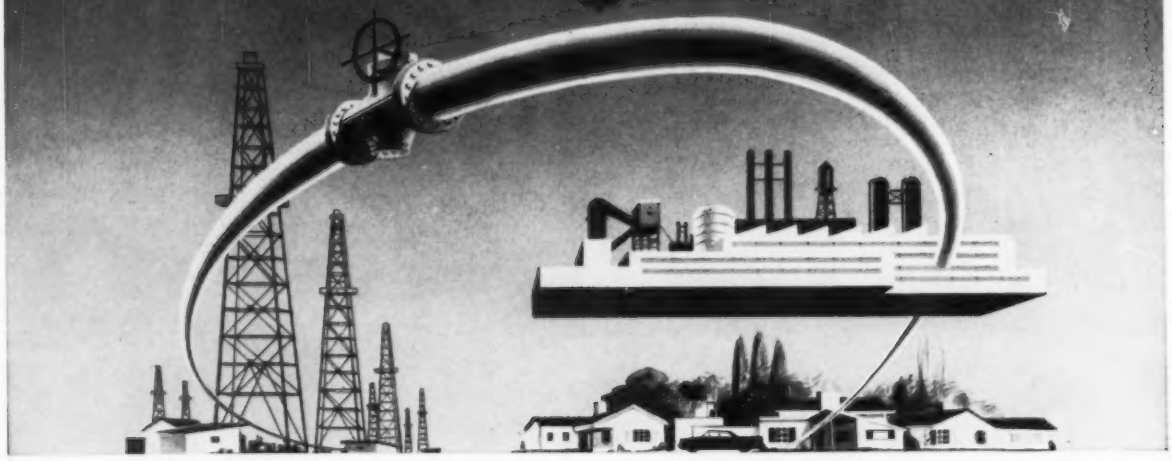

Since the first commercial gas odorant production, Oronite is proud to have become an integral part of the gas industry. Manufacturing and technical facilities have been continuously expanded through the years to fulfill the ever-growing requirements of this dynamic industry. Today, and in the years ahead, you can look to Oronite for the finest odorant products and most complete service.

Oronite's service to customers is unequalled!

Oronite maintains a technical field service staff of trained odorant specialists who work closely with the utility and transmission companies. These men are backed by extensive laboratory facilities to assist in solving individualized customer problems. As a further service, Oronite's unique odorometer offers the simplest way to test odor intensities and determine adequate odorization.

A phone call or letter to any Oronite office will promptly bring an odorant specialist to consult and assist you on gas odorization.

Oronite's complete and versatile line of gas odorants!

Calodorant® C—completely stable cyclic sulfide-type odorant
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4209

Utility ratemaking during inflation

PENNSYLVANIA, in a recent case, recognized the impact of economic forces on the earnings of a natural gas distribution company. The commission allowed for increases in the cost of purchased gas, higher wages, increased taxes, and the present value of property used in rendering service. The majority of the commissioners found that a 6.4 per cent return on a fair value rate base of $97 million would be reasonable, while two commissioners considered 6.5 per cent return to be fair.

During a period of inflation it is especially important that prompt and adequate rate relief be available to utilities from the regulatory agencies. Any reduction in the time required to process a rate case to decision will decrease the utility's unrecoverable monetary loss, because rates cannot be made retroactive to the date of filing the request.

Before analyzing the important aspects of the Pennsylvania gas rate decision, let us consider the measure of compensation necessary to keep a utility rendering dependable service.

Utility service related to rates

A regulatory commission has a duty to encourage good utility service as well as to prescribe reasonable rates. To provide prompt, adequate, and dependable service a utility must be financially strong. Financial strength is required to insure the confidence of investors in the basic earning capacity of the capital that is already invested in the utility, and to attract the necessary amount of new capital, on reasonable terms, to provide for additions and replacements of facilities.

A utility is in competition for the investors' money with other utilities and nonregulated businesses having comparable risks. The objectives are that investors will retain the utility securities they now own; they will make purchases in the market of securities between new issues; and they will buy large blocks promptly when new securities are offered. To develop financial vitality, therefore, a utility must pay a competitive return on its bonds and stocks. To enable a utility to pay competitive returns on the investment, it is essential that the regulatory commission authorize it to charge compensatory rates for service.

There is, of course, no guaranty of a fair return—but only a guaranty of an *opportunity* to earn adequate compensation — an elementary distinction but one commonly overlooked. The compensation which the Constitution guarantees this opportunity to earn must be sufficient to reimburse the utility for operating expenses, depreciation, and taxes, plus a fair return. A fair return, being the wages paid for the use of invested capital, is just as much a part of the cost of rendering service as wages for labor. The utility's return to be considered fair must meet the contracted financial requirements of its bonds and preferred stock, and the economic obligation to pay competitive dividends on the common stock while retaining some earnings in the business.

Rate making involves the balancing of the interests of both utility consumers and investors. Utility regulation serves as a substitute for competition, protecting the consumer from unreasonable charges that might result from monopoly, but concurrently affording the investor a reasonable return on his investment when compared with earnings on investments in other businesses with corresponding risks. The legal principles governing rate making are the outgrowth of economic facts. They seek to achieve reasonable prices and returns which would be the result from competition in the open market.

Rate base

Now to comment on the important Peoples Natural Gas rate case. The Pennsylvania commission found the gas company's method of determining the present value of its property acceptable. The company developed a trended original cost at the average prices for material and labor in 1955, by applying trending factors to the original cost of facilities by years of installation.

A monthly commentary on national and state developments by an expert in the field of utility law.

Regulatory trends . . . Periodic changes have been the pattern

In adopting the fair value rate base of $97 million, the commission considered the evidence showing the measures ranging from $77,-612,000 for original cost to $121,-769,000 for trended original cost at 1955 price levels.

The amount of net revenue a utility is allowed for servicing its debt and stock was determined by multiplying the fair value rate base by a 6.4 per cent return.

Fair return

The Pennsylvania commission rejected the company's claim for a 7 per cent return and made the following conclusions:

"What fair rate of return a Pennsylvania utility is entitled to is largely determined by competitive forces in the capital markets. Market statistics reflect the competition for capital, and therefore the cost of capital based on market evidence reflects the appraisal by investors of the relative risks of natural gas utilities compared with other industries. Since the market statistics reflect investors' current demands, a rate of return based on the cost of capital assures access to the capital markets on terms established by the investors themselves. The allowable return on capital investment in public utilities is therefore governed by the current market for capital.

"The evidence here indicates that respondent's claims for cost of debt capital are reasonable and that its claims for the cost of common equity capital are excessive. The evidence also indicates that the fair rate of return for respondent may be determined reasonably on the basis of a capital structure containing 40-50 per cent debt and 50-60 per cent common equity capital.

"Based upon the evidence, we find 6.40 per cent to be the reasonable and fair rate of return to be applied to our fair value finding of $97,000,000, resulting in an allowable return of $6,208,000."

The allowed return of 6.4 per cent on a fair value rate base, which was $20 million greater than the original cost less accrued depreciation, produces a higher dollar return than the national average for comparable gas companies. A survey has been made of the rates of return allowed by commissions throughout the United States for natural gas distribution utilities during the past two years. The national average return authorized was 6.39 per cent related to a depreciation original cost rate base. Of course, a fair value rate base during the current period of inflation is always higher than the original cost, because prices for material and labor have jumped since World War II.

Accelerated tax depreciation

The Pennsylvania commission has pioneered on the subject of accelerated tax depreciation in ratemaking. The commission considers a utility to have realized a tax saving when it elects to take accelerated depreciation for income tax purposes. The commission, therefore, has passed all the benefits on to the ratepayer. In this present rate case, the company claimed income taxes based on depreciation deductions calculated by the straight line method and not on any of the optional accelerated depreciation methods under the revenue code. The commission did not force the gas company to take the option or its consequences. It reasoned that the utility had exercised an option in declining accelerated depreciation, and that such action was not an abuse of managerial discretion. The commission warned the utility about claiming accelerated depreciation after the gas rates were prescribed. The commission stated, "The utility is on notice of the commission's position in the Manufacturers' case that minimization of taxes by way of acceleration of depreciation constitutes a tax saving, not a tax deferral, which must inure to the benefit of the consumer."

There is a hot debate throughout the United States concerning this subject. Thirty-two regulatory bodies have stated their views on accounting for Federal income taxes resulting from the use of accelerated depreciation. In all but two jurisdictions normalized taxes and depreciation are recorded in the books of account, and the temporary tax reduction is treated as a deferral by placing it in a tax reserve, or restricted surplus account. The majority opinion is that the charging of greater depreciation during the early life of property, and the charging of less during the later life operates to create a deferral on income taxes.

The Pennsylvania commission's action in a rate case that only actual taxes paid under accelerated depreciation options should be allowed in fixing gas rates would not provide funds for construction of utility facilities. Congress considered it to be in the national interest to postpone such tax revenue and allow the taxpayer to use deferred tax funds to finance expansion with the expectation that this would stimulate the economy.

The "tax-saving" school of thought relies on two improbable assumptions both of which would have to be true in order to change the nature of tax deferrals and convert them into tax savings. These assumptions are that the present tax laws relating to depreciation will never be changed, and that utilities will continue to grow at annual rates which would produce tax savings forever.

Those two assumptions have little chance of becoming actualities. Periodic changes in the tax laws have been the pattern and the sources of natural gas will not last forever. In addition, no known source of energy is assured its present position in meeting the requirements of the public in the future. Only change and obsolescence seem assured.

The Pennsylvania commission by its tax-saving theory, in connection with the use of accelerated depreciation, has missed an opportunity to benefit rate payers and utility investors. ■

16" Feeder Gas Main in a Large Mid-western City Subdivision.

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This filter is used by utilities to stop lamp black and moisture from entering regulators and pilots . . . reduces customer complaints and service calls. Also used in natural gas lines for removing anything from dry oxide dust to oily deposits left from fogging operations. Model CPHG Gas Filter is available in a wide range of sizes . . . pressures to 10,000 psi . . . to handle 100,000,000 cu. ft. or more per day.

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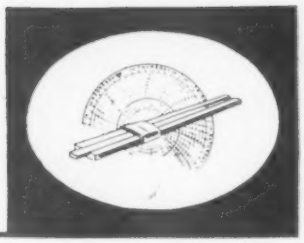
technical trends



By GUY CORFIELD

The weather, air pollution, and the gas industry

We are, of course, profoundly influenced by the atmosphere around us, and the weather which it produces and which makes us conscious of it. Contrary to the oft-repeated quotation, we are doing something about the weather or, to state it more properly, to the weather. On a long-term basis, which could become important more rapidly than we realize, scientists believe that our use of fuels is making the world warmer. They calculate that more than half of the carbon dioxide released into the atmosphere by burning during man's history on earth has occurred in the last 50 years. This may have permitted increased solar heat penetration to raise the earth's temperature as much as 1° F. With our increasing use of combustion-produced energy, general climatic changes could come upon us rapidly. Transformation from the Ice Age to the present climate of the temperate zones, and through to subtropical conditions, is believed to be a matter of a relatively few degrees F.

More immediately important and evident, our centers of population are periodically smothering in their self-produced "climate" of air pollution. Several generations ago English school children traced in their copy books "What is the wind for? To blow the ships across the sea, and carry away all bad smells." The wind may have been frequent and sufficient in those days, but we can no longer depend on it to ventilate our large cities and industrial areas. There is an increasing realization that emissions to the atmosphere must be controlled, indoor air conditioning must be more widely used, and certain activities must be dispersed or located with due regard to climatic conditions. As stated in the keynote speech at a recent heating and air conditioning conference in Chicago, "The alarming increase in air pollution is dangerously speeding up the biological unbalance of the earth's atmosphere. This mounting threat to survival can only be effectively coped with by massive coordinated efforts by teams of specialists."

Air pollutants have many origins, some coming from specific industries and processes, but most from the everyday and normal activities of the general public: automobile and truck operation, combustion for power and heat and refuse disposal, painting and cleaning, etc. The contaminants are gases, aerosols (liquid or semi-solid droplets), and dusts. They mix and react with each other, and with atmospheric oxygen and water vapor, under the influence of sunlight. The result is "smog," which so far has defied complete analysis and identification. It can be defined by its effects of haze, eye and throat irritation, plant damage and, in the extreme, impairment of health. Our scientists are busy exploring this new field of dilution and photo chemistry, but still have much to learn.

The gas industry should have much more than a passing interest in air pollution. As a major supplier of fuel that obviously burns and produces combustion products, it can readily come under suspicion. People who are unaware of the excellent combustion characteristics of fuel gas, or who may have encountered defective performance, will be quite ready to blame gas for atmospheric contamination. On the other hand, the gas industry can be applauded for furnishing the cleanest of fuels, and well-designed appliances for its utilization. It can take credit for substantially contributing to clean air by reducing the need for other fuels that are far greater contributors to pollution. It can even point out that for any heating purpose, less fuel need be burned to apply gas heat directly, than to convert heat to electricity and then back to heat.

It follows that to be ready for either defense or offense, the industry should follow closely the activities of local, regional and national air pollution control organizations. It should have complete knowledge of the combustion characteristics and products of solid and liquid as well as gaseous fuels under the various conditions of utilization. And it should be always on the alert to ensure that gas is being used for all purposes in the most efficient manner.

Solar furnace

Arthur D. Little Inc. is advertising a solar furnace which is claimed to produce up to 3500°C (6300°F) of "pure heat." Pure heat means that the heated object is not exposed to combustion products, and can be simply supported without contamination from a crucible or other enveloping container.

A 60-in., stellite-coated paraboloid mirror focuses sun rays on a 6-mm diameter (about ¼-in.) area. Temperatures are measured and the results observed through a viewing port at the back of the reflector. Merely opening or closing shutters between the sun and furnace controls temperature. Motors automatically keep the entire assembly facing the sun.

The greatest use for the furnace is probably very high temperatures material research. Doubtless, there will be application to some manufacturing processes requiring intense heat on small areas and freedom from external contamination.

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TYPE 630

FOR INLET PRESSURES UP TO 1500 psi

Fisher's famous Big Joe Type 630 is the best regulator for rugged high pressure jobs. It's ideal for Farm Taps, Small Border Stations, and Industrial Installations. For completely dependable service, there is no regulator like the Big Joe — it's backed by thousands upon thousands of installations along the major pipe lines of this country.

TYPE 620

MAXIMUM OPERATING INLET PRESSURES UP TO 750 psi

(Maximum allowable inlet pressure 1000 psi)

The Fisher Type 620 pounds to pounds regulator is especially designed for *economical* first stage reduction of gas pressure for farm taps on high pressure transmission systems.

Also suitable for industrial gas applications, as a Propane tank reducing valve, and for numerous other installations where good regulation is required on gas service.

Write for New Fisher Bulletin P-11.

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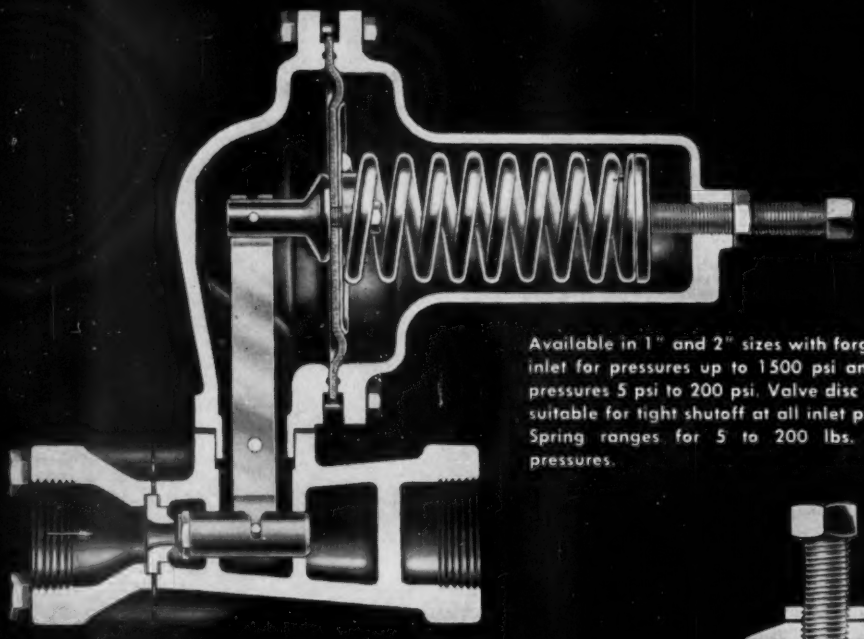
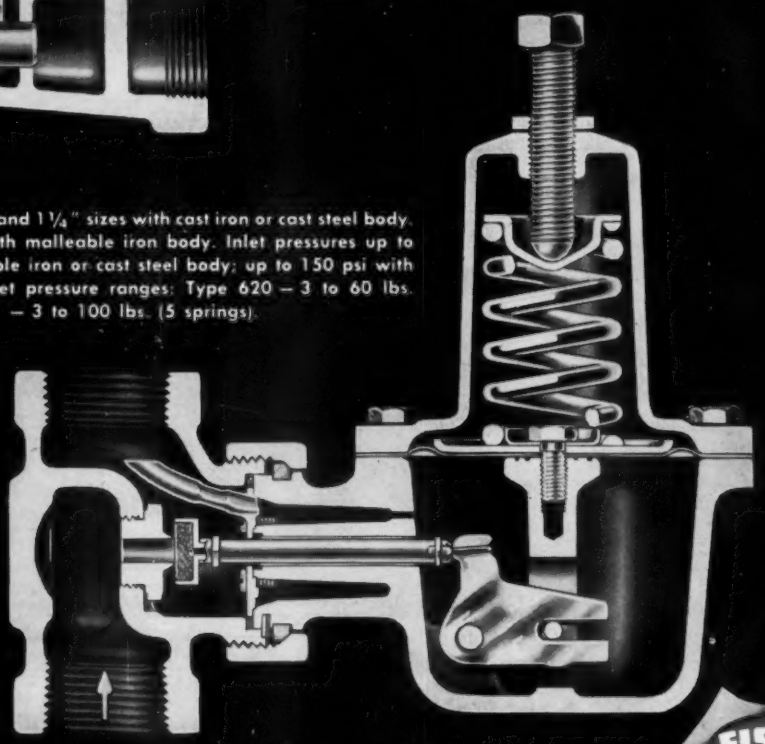


Available in 1" and 2" sizes with forged steel inlet for pressures up to 1500 psi and outlet pressures 5 psi to 200 psi. Valve disc material suitable for tight shutoff at all inlet pressures. Spring ranges for 5 to 200 lbs. reduced pressures.

Available in ¾", 1" and 1¼" sizes with cast iron or cast steel body. ¾" and 1" sizes with malleable iron body. Inlet pressures up to 750 psi with malleable iron or cast steel body; up to 150 psi with cast iron body. Outlet pressure ranges: Type 620 — 3 to 60 lbs. (4 springs). Type 621 — 3 to 100 lbs. (5 springs).



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JAEGER'S 50 CFM MORE AIR SPEEDS RUSH WORK

By producing 365, not 315, cfm of 100 lb. air, this Jaeger Rotary is operating six 80 lb. breakers at full efficiency to finish a rush job in busy Benjamin Franklin Parkway, Philadelphia. Full load speed only 1700 rpm.

FULL AIR PRESSURE AT 5200′ ELEVATION

Installing cable for Denver, Colorado utility, this Jaeger "125" Rotary is holding full pressure in two Thor heavy duty breakers. Full load speed is only 1700 rpm. Jaeger originated the 125 cfm compressor rating.

JAEGER'S 125 AND 250 CFM SIZES ON 2-WHEELS

Jaeger 125 and 250 rotaries give you the advantages of Jaeger's higher efficiency (1700 rpm full load speed instead of 1800-1950), plus full size tool boxes, retractable pneumatic-tired dolly wheel and 8-hour fuel tanks, with 2-wheel mounting. Four-wheel units are available in 365 and 600 cfm sizes.

Your Jaeger distributor will gladly give you full details and demonstration — or let us send you Catalog JCR-5.

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THE ROCKWELL

GAS REPORT

DEVOTED TO THE INTERESTS OF THE GAS INDUSTRY

VOL. 2 JULY 1957 NO. 2

BRAINSTORMING . . .

. . . digging for ideas to help you

The photo above shows a group of Rockwell engineers at a recent "Brainstorm Session." These sessions are designed to produce an interchange of ideas with particular emphasis on purely creative thinking about how to solve pre-stated problems. In a meeting such as this, comments like—"We tried that before and it didn't work" and "Good, but the boss won't like it"—are ruled out. Even wild ideas are encouraged because experience proves that it is far easier to tame down a wild idea than it is to pep-up a dull one. Also, wild ideas often stimulate other members of the group to think about a more practical approach.

"Brainstorming" is just another example of the *creative engineering* that is an unseen part of every Rockwell product for measurement and flow control. As an example, a number of years back it was thought impossible to use aluminum for gas meters. But, by use of new aluminum alloys and specially developed die-casting techniques, Rockwell pioneered the durable, highly corrosion-resistant aluminum gas meter housing.

The topic being discussed by the men in the photo above is, "Subjects for the ROCKWELL GAS REPORT." The articles that you read in this section and the ones to follow originated at this meeting. However, if you should have any special problems or unique ideas that you would like us to "Brainstorm" or report, please don't hesitate to write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

ROCKWELL Meters and Regulators

ROCKWELL-Nordstrom Valves

THE GAS METER OF THE FUTURE

May Be Made of Plastic

by L. A. McGowan, Chief Engineer,
Meter & Valve Division, DuBois Plant, Rockwell Manufacturing Co.

It has been said many times and in many ways that gas meters have not changed for fifty years. This statement rings true with respect to basic principles of operation and it is partially so from the standpoint of certain engineering design principles. Meters *have changed*, though, in material design and in material application. For this reason, it is entirely conceivable that gas meters in the next fifty years will be constructed almost entirely of plastic materials.

Today's gas meters are far more accurate and far more durable than the gas meter of fifty years ago. Technical improvements in materials available to the engineer for use in the manufacture and design of gas meters have been the major reasons for increased accuracy and improved durability. For example, the use of aluminum has materially decreased meter weight and improved the appearance . . . and, in a majority of applications, aluminum has also improved the corrosion resistance. The use of lubricated powdered metal bushings and bearings is another contribution towards the elimination of wear as a problem. It does not seem too unreasonable, then, to suggest that future use of plastic materials may further decrease the weight, improve appearance, decrease wear, and eliminate noise in gas meters.

Plastic Already in Use

Plastic materials are already used to a limited extent in gas meter construction. For example, valve covers made of a phenolic material have been in use for approximately twenty years. Plastic insulated connections of various designs and materials are also being used at present. Through limited applications such as these, considerable engineering data and practical experience have been gained.

In the very early phases of plastics, much harm was done by misapplication of materials. Cheap toys, easily damaged kitchenware and a host of other plastic products of inferior quality and design teamed-up to give plastics a bad name.

Today, plastic materials are available in an infinite variety of types and kinds. These materials have a full range of physical, chemical and mechanical properties. Plastics engineering and technology have now progressed to the point where structurally sound, functional and reliable industrial parts made of plastic are a firm reality. In fact, it is now considered that many plastic materials are truly *engineering materials*. This means that sufficient engineering tests and data have been accumulated so that the engineer or technician can logically predict the chemical and mechanical properties of many plastics. Like with most metals, then, he can logically recommend the proper material for a specific job.

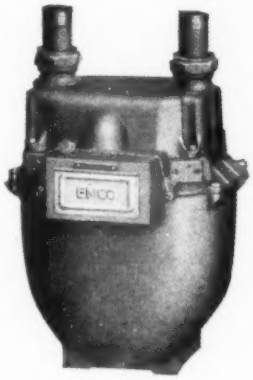
Versatility of Plastics

Plastic is a very general term covering an infinite number and variety of synthetic materials and combination of materials. In considering plastic materials for use in gas meters, it is necessary to evaluate the requirements and performance of each individual part under consideration. For example, a proper material for gas meter housings should have high impact strength, dimensional stability, electrical insulation and corrosion resistance.

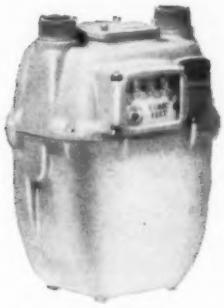
In order to fulfill all of the many requirements of a plastic material for use in a gas meter housing, the first requirement is a detailed consideration of each of the major classifications of plastic materials which might possibly do the job. Samples have to be made and extensive laboratory tests conducted before determining which of the many materials are best suited for further field testing. In a strict engineering analysis of plastic materials, a primary need is sufficiently high impact strength and mechanical properties to prevent damage in any normal handling. Also, the material must be a non-conductor of electricity; must be highly corrosion resistant; must be dimensionally stable from −50° F to 400° F. When all these requirements are met, as well as many others, it is possible that a plastic gas meter housing will be available which will not require insulation; which will have superior resistance to corrosion and which will substantially decrease maintenance costs by eliminating the need for painting.

In certain engineering samples and experimental work already under way, meter housings have been designed to accommodate the internal mechanism of a meter which has been accepted, tried and proven in aluminum die cast meters. These samples will enable field trials and tests of plastic housings without posing a problem as to the effect of the plastic material on the proof or performance of the meter.

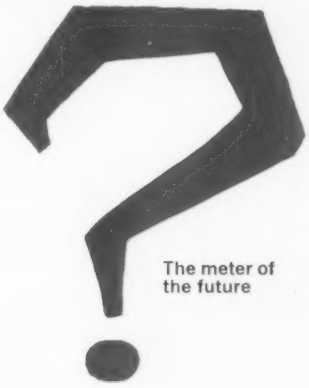
A dramatic example of the beauty and durability of modern plastics is the Chevrolet Corvette with its plastic reinforced fibreglass body.



Early cast iron meter



Modern Rockwell aluminum meter



The meter of the future

In conjunction with the work on plastic housings for gas meters, consideration has been taken of the potential for plastics in *all* of the other parts of the meter. With materials readily available today, practically all parts of the internal mechanism of a gas meter represent a possibility for some type of plastic. In the vast majority of these potential applications, an improvement in quality of the meter would be a definite possibility. Because of the extreme importance of not in any way affecting the performance or proof of a gas meter without long and extensive tests, considerable additional work is now being done on these parts. Much interesting information has already been gained. It is known, for example, that some of the materials under test will someday offer definite improvements to the metering of natural gas.

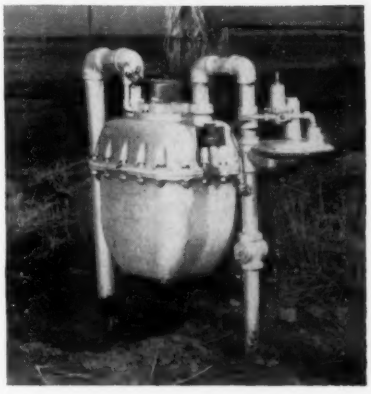
Search for Improvement

There are other engineering reasons for the consideration of plastic as a gas meter material. Plastic suppliers are now in a position to replace materials that are or could become critical from a supply standpoint. And, as the supply and use of plastic materials increase, they may someday soon have a cost advantage over metals.

Engineering-wise, we are most interested in improving the performance of gas meters. It may be possible that someday a plastic meter could be designed which would utilize all of the qualities and advantages of plastic materials. We believe that after the necessary tests, experiments and field trials have been completed, plastic materials will aid us in accomplishing this purpose in the manufacture of gas meters.

The fact that plastic materials have truly become engineering materials points up a prophesy that a plastic gas meter may well be the gas meter of the future.

Natural Gas Engines for Irrigation



Natural gas has proved an ideal fuel for powering irrigation pumps in Southwestern cotton and rice fields. Both of these crops require large quantities of water—especially rice—and hence extensive pumping facilities. Other fuels are usually not economical in view of the extensive power demands.

Natural gas is provided through direct taps from main transmission lines or from higher pressure distribution lines. A typical measurement and regulation set-up is illustrated above with the No. 800 Rockwell large capacity meter and No. 173 pressure regulator.

An Economical, Efficient

FLOW CONTROL STATION

by H. J. Evans, Chief Engineer,
Central Gas Engineering, Rockwell Manufacturing Co.

The Flow Control Station with a downstream capacitance (underground storage, holder, large pipeline capacity, etc.) maintains a maximum demand flow rate, which prevents distribution peak loads from affecting transmission line loads. This permits a constant transmission line flow rate for high transmission efficiency and economy.

Application and Operation

The Flow Control Station is used where storage is available and a set demand flow from the transmission line is desired.

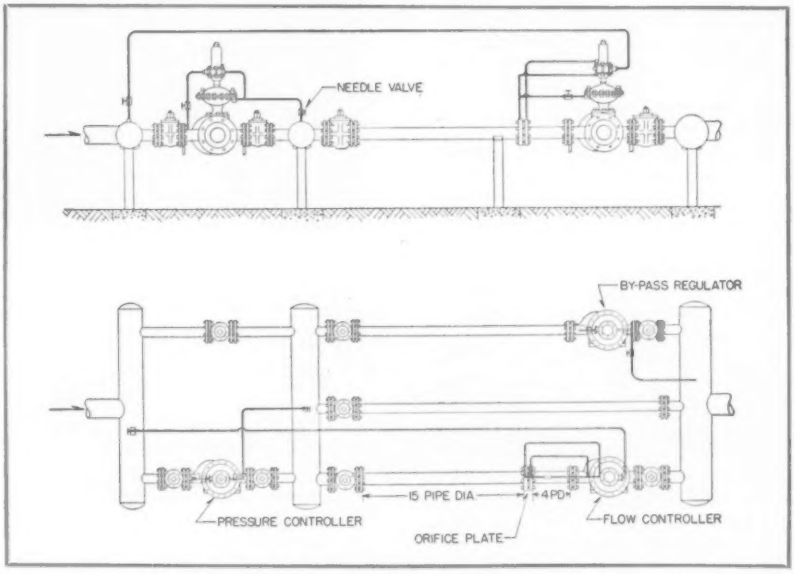
The Flow Controller maintains a maximum demand flow from the transmission line by controlling the pressure differential across the orifice plate. The differential is usually about 4 to 7 psi. and the orifice plate must be sized for the flow required to give this differential. The By-Pass Regulator is set for the minimum downstream pressure and the Pressure Controller for the maximum downstream pressure. If the demand downstream exceeds the Station flow rate, the storage will yield its supply until the downstream minimum line pressure is reached, at which time the By-Pass Regulator will open, providing emergency flow. If the downstream demand is less than the Station flow rate, storage will be filled until the maximum downstream pressure is reached, at which time the Pressure Controller will close (the Flow Controller will open wide) to maintain the maximum downstream line pressure. Constant flow across the orifice plate will be maintained at all times except when the downstream pressure reaches the maximum setting. Proper sizing of the Station with relation to normal demand and storage available will permit maximum demand flow to be maintained, except for unusual load periods.

How the Station is Operated

This should be accomplished when downstream flow is less than the desired Station maximum demand flow.

1. Make sure all valves including needle valves are closed.
2. Slowly open By-Pass Regulator outlet valve and control line needle valve.
3. Open By-Pass Regulator inlet valve.
4. Slowly open Pressure Controller "by-pass valve," and adjust By-Pass Regulator for Station Minimum Pressure setting.
5. Slowly open Pressure Controller outlet valve and control line needle valve.
6. Slowly open Pressure Controller inlet valve and Pilot supply line needle valve; throttle flow of Pressure Controller "by-pass valve" and adjust Pressure Controller for the Station maximum pressure setting; close by-pass valve.
7. Slowly open Flow Controller outlet valve and control line needle valve.
8. Slowly open Flow Controller pilot supply line needle valve and Flow Controller inlet valve.
9. Adjust Flow Controller for demand flow and replace adjusting cap. Observe operation until maximum downstream pressure is reached, at which time the flow chart should indicate a reduced flow. To recheck, close Flow Controller Pilot Supply needle valve until downstream pressure reaches the minimum setting; slowly open Flow Controller Pilot Supply and permit downstream pressure to return to maximum setting pressure. The chart curve will show a small change in differential for the two extremes of downstream pressure.
10. Adjust needle valve on Flow-Controller control line to dampen regulator if required.

Regulators having needle valves installed in the control piping which does not originate at the regulator, should be removed from service by closing the pilot supply line needle valve first and then the control line needle valve, before the block valves are closed. This will prevent any possibility of damage to the regulator diaphragms from overpressure.



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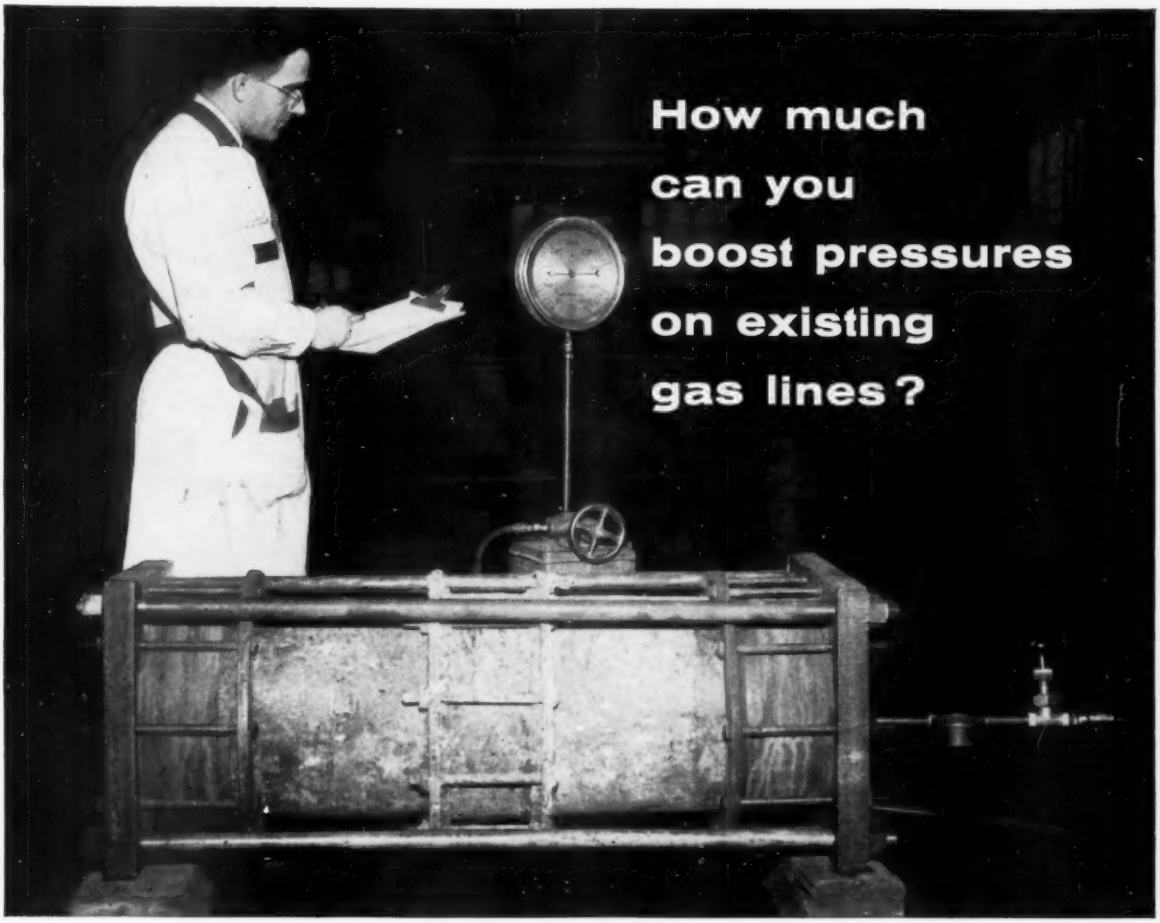

After being buried underground 14 years, this style 38 Dresser Coupling was taken to a testing laboratory and subjected to 1800 psi internal hydrostatic pressure. No leaks appeared.

Here's the story of how one company was able to double pressures on an important line.

By Fred Newell, Chief Product Engineer,
Dresser Manufacturing Division

Here's how Manufacturer's Light & Heat Company, Pittsburgh, discovered it was possible to double pressure on a 14-year-old line: One of their 16″ pipelines was originally joined in 1942 with Dresser Couplings. So they asked Dresser to test two sections of pipeline prior to pressure tests on the line itself. In each instance, the sections were dug up and taken to Dresser laboratories without disturbing the 14-year-old couplings in any way. The line previously operated at a maximum of 380 psig.

Couplings tested to 1800 psi

Hydrostatic test equipment was fitted to each section and pressure tests began at zero psi. Pressures were increased in increments of 200 psi and continued up to 1800 psi without a sign of a leak at the Dresser Couplings. At this point the testing equipment reached its limit and the test was terminated.

Even with every other bolt removed, these 14-year-old Dresser Couplings took a pressure of 1375 psi without leaking.

The coupling gaskets were then checked and found to be in excellent condition. Since the couplings were expected to withstand only 600 psig for their new intended use, it was obvious that they could handle the job with plenty of extra strength to spare.

Manufacturer's Light & Heat Company then tested the line in place to 660 psig without leakage, thereby qualifying the line for 600 psig operation. Thus the time-proved dependability and sound engineering principles inherent in Dresser Couplings will provide important savings in rehabilitation costs on these lines and permit an immediate increase in gas service to Manufacturer's many gas customers in Western Pennsylvania.

Your Dresser Sales Engineer will be glad to give you further information . . . or write us direct. Dresser Manufacturing Division, Bradford, Pa. Sales Offices in: New York, Philadelphia, Chicago, San Francisco, Houston, Denver and Atlanta. In Canada: Toronto, Calgary.

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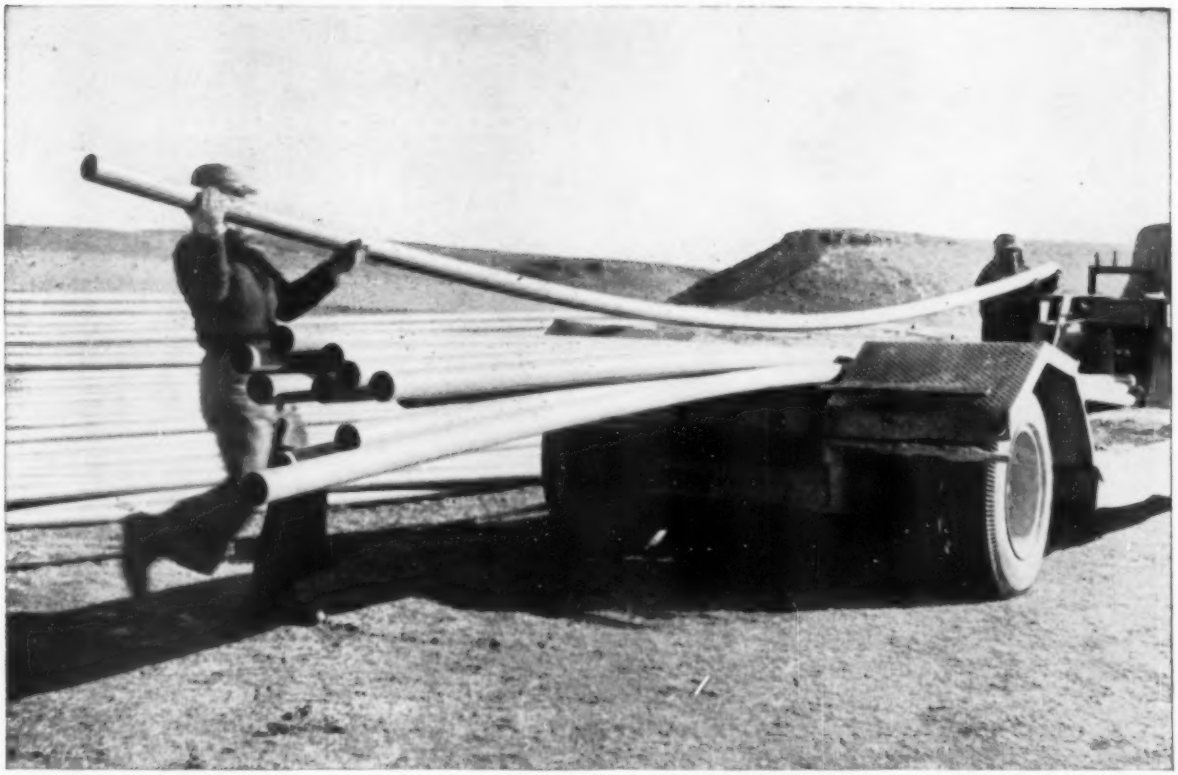

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Fast Assembly. . . *Pipe is joined with fittings and solvent cement. A sound joint can be made in less than a minute.*

. . . install Geon rigid vinyl

YOU can now obtain rigid vinyl pipe and fittings made of Geon polyvinyl materials from leading manufacturers. This remarkable plastic is immune to galvanic corrosion, eliminating the major source of failure of underground lines. It is highly resistant to salt water and sour crude oil, as well as to most corrosive chemicals.

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These advantages of Geon piping are easily realized. The piping is lightweight, easy to handle, simple to install. You'll save on time and labor . . . as well as on lifetime cost. For new booklet listing properties of rigid Geon write Dept. FO-4, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

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B.F.Goodrich GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

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basic machines for NO-BLO® operations

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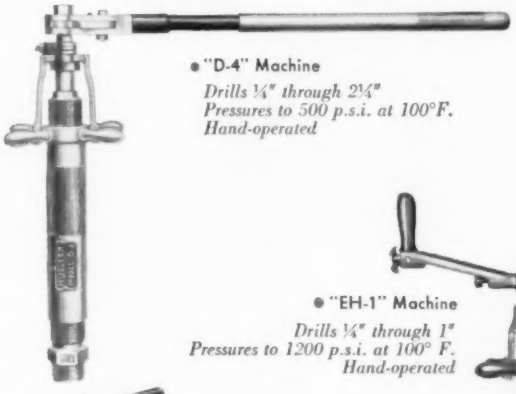
Drills ¼" through 1"
Pressures to 500 p.s.i. at 100° F.
Hand-operated



• **"D-4" Machine**
Drills ¼" through 2¼"
Pressures to 500 p.s.i. at 100°F.
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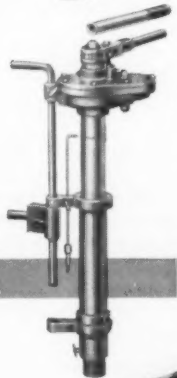

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Pressures to 1200 p.s.i. at 100° F.
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Drill the main, insert and extract plugs or stems, recondition valve seats and make stop-offs with No-Blo fittings and these basic No-Blo machines.

All of these operations may be done under full line pressure, in complete safety, without loss or blowing of gas or interruption of other services.

Contact your Mueller Representative or write direct for your copy of the latest No-Blo booklet "Make Installations Under Pressure" — an illustrated, step-by-step story of No-Blo installations.

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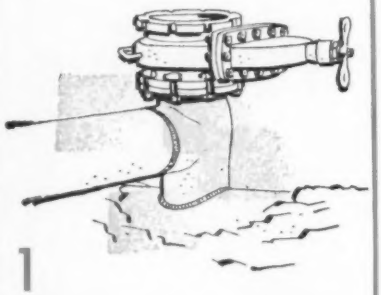
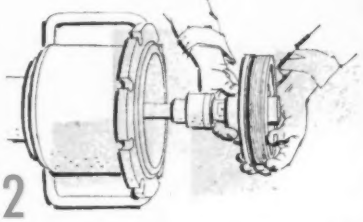


1

Weld tee to main and complete lateral to first valve. Test welds. Bolt Mueller gate valve—**hand tight**—to flange of tee. Open valve.



2

Attach completion plug and alignment tool to shaft of completion machine. Bolt completion machine—**hand tight**—to gate valve. Carefully align valve and machine with tee to permit inserting completion plug into top of tee. Tighten all bolts solidly. Mark position of completion machine on gate valve. Remove plug and machine.

3

Attach proper adapter, pilot drill and shell cutter to boring bar of Mueller C1-36 Drilling Machine. Bolt drilling machine to gate valve. Make cut into main using air motor or portable gasoline engine drive unit to power drilling machine. Retract boring bar, close valve and remove machine.

MUELLER NO-BLO® Method

BRANCH MAINS

■ *quickly* ■ *safely* ■ *under pressure*

■ A simple method of connecting large lines to an all-welded steel system is to use a Mueller Flanged Tee with a Mueller C1-36 Drilling Machine.

Contoured inlets, beveled outlets and the use of line pipe analysis steel in Flanged Tees assure fast, easy field welds. Use of the NO-BLO® Plug in top of tee makes it possible to recover the expensive valve used during installation.

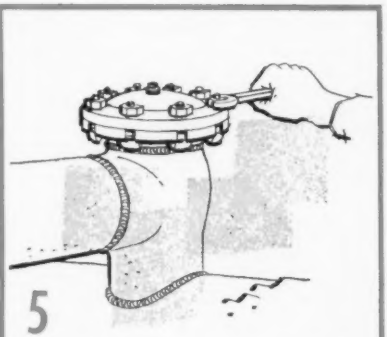
Optional power units for the C1-36 Drilling Machine give smooth, clean cuts through any size pipe.

Strong, permanent connections, with a minimum of excavating, are the result. And the entire installation is completed under pressure without escape, loss or blowing of gas or interruption of service to customers on the main.

Tees are available with 150, 300, 400 and 600 pound flanges for pressures up to 1200 p.s.i. Sizes 3″, 4″, 6″ and 8″.

4

Attach completion plug and inserting tool to shaft of completion machine. Bolt completion machine to gate valve in same position as marked. Open valve and insert plug firmly into top of tee. Test for tightness. Release plug and remove machine and gate valve. Test entire set-up with soapsuds.



5

Position gasket on flange of tee and bolt completion cap firmly in place. Lateral connection is now completed and ready for backfilling.

STOP-OFFS. Completion plug may be removed at any future time and stop-offs made by using a special stopper and NO-BLO Line Stopping Equipment.

RE-USE. Flanged Tees may easily be salvaged upon abandonment of main for re-use on other lines.

Ask your Mueller Representative or write direct for the NO-BLO Method Booklet "Make Installations Under Pressure". It shows how many gas service installations may be made in complete safety, without loss of gas or interruption of service to customers.

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Since 1857

Practical lay-away plan for storing gas ...in NATIONAL SEAMLESS STEEL BOTTLES

BURIED UNDERGROUND in National Seamless Steel Bottles . . . that's the method practical utility companies are now using to store their natural gas. Buried underground . . . out of harm's way; safe from storms, high winds and lightning . . . where there are no hazards to or from aviation.

And once they are in the ground, Seamless Steel Bottles require minimum maintenance: no periodic painting needed, fewer inspections necessary. And there is no danger from vibration or settling, as in surface installations.

Because underground temperatures are more stable, there is usually less, and sometimes *no* fluctuation of gas pressures. However, when minor repairs or inspections are in order, any group or string of bottles can be taken off the line without affecting the gas pressure of the remaining groups of bottles.

Fifty Seamless Steel Bottles—averaging 39′ in length x 24″ in diameter—will hold 1.4 *million* cubic feet of natural gas at 2400 psi.

National Seamless Steel Bottles are pierced from solid billets of the highest-quality steel. Before shipment every one is inspected and subjected to severe high-pressure hydrostatic tests. You are thus assured of safe walls and efficient performance throughout long years of service.

The underground storage technique deserves your careful consideration. You can get detailed information on National Seamless Steel Bottles by writing to: National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

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USS

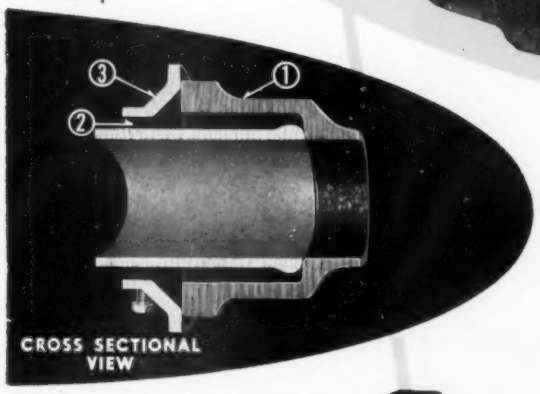
WALLS WITHOUT WELDS

NATIONAL SEAMLESS STEEL BOTTLES

UNITED STATES STEEL

Simplified Bell Joint Clamps

1. Bell joint
2. Perma-Seal Compound
3. Bell joint clamp



SEALED BY ADHESION

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WITH THE FOLLOWING ADVANTAGES:

- Smaller street openings required because no excavating or cleaning necessary in back of the bell.
- The clamp does not require adjustment, or filling and facing of the bell.
- ***The clamp is engineered to fit all variable pipe wall thicknesses without adjustment and to fit all types of bell joints including sleeves, drip pots, valves and odd size pipes.*** Available sizes: 3" to 36" diameter.
- This clamp fits in confined areas because it requires no greater area than the existing bell for installation.
- ***This leak clamp becomes a seal by adhesion rather than by compression.***
- This clamp allows ground movement and vibration to take place without the danger of leaks after installation.
- Once installed the joint becomes trouble-free and permanent.

Write: for full information and prices about the Newest Method in Pipe Connections

New Perma-Seal and Safety Seal Weld sleeves available for steel to steel, steel to cast iron, split sleeves for repair of steel pipe, and completely insulated sleeves for corrosion control.

Typical installation in the removal of valve and replaced with safety seal weld sleeves.

Steel to steel sleeve

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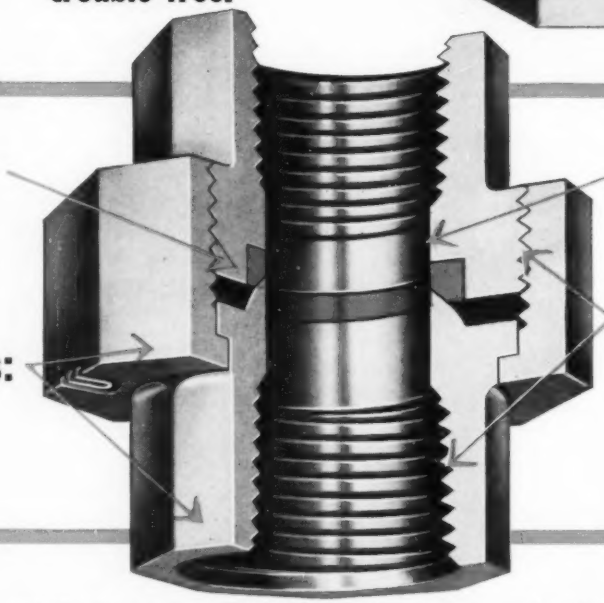
UNITED PIPE LINE CONTRACTORS, INC. BOX 839, BELOIT, WISCONSIN

Test Proves Rugged U-Brand Union leakproof at 8000 p.s.i.g.!

you get added safety on every installation!

Recent tests conducted by Herron Testing Laboratories, Inc. prove the superior quality of U-Brand 150# unions. Five well-known brands were subjected to internal hydrostatic pressure after assembly at 64 foot pounds torque. Only one matched U-Brand's non-failure at 8000 p.s.i.g. All others failed at 30 to 80 per cent of this pressure. Proof of U-Brand's unexcelled safety factor over rated capacity. That's why it pays you to buy and install U-Brand unions.

You get fast, easy-to-make installations that are leakproof and trouble-free.



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Machined copper-to-iron joints furnish positive seal.

Straight Flats:

Secure wrench grip speeds installation.

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There are no obstructions to start build-up.

Easy Threading:

Chamfer and threads are exactly machined then fully inspected before shipment.

U-Brand Unions are more protection for your money. Distributed through wholesalers everywhere. Insist on U-Brand; it's more fitting!

A single source for all your pipe fitting needs

Galvanized and Black U-Cote Malleable Iron Pipe **Fittings**—Unions—Plugs and Bushings—Cast Iron **Drainage** and Screwed Fittings—Steel Nipples and **Couplings**—Insert Fittings for Plastic Pipe.

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in your network expansion program?
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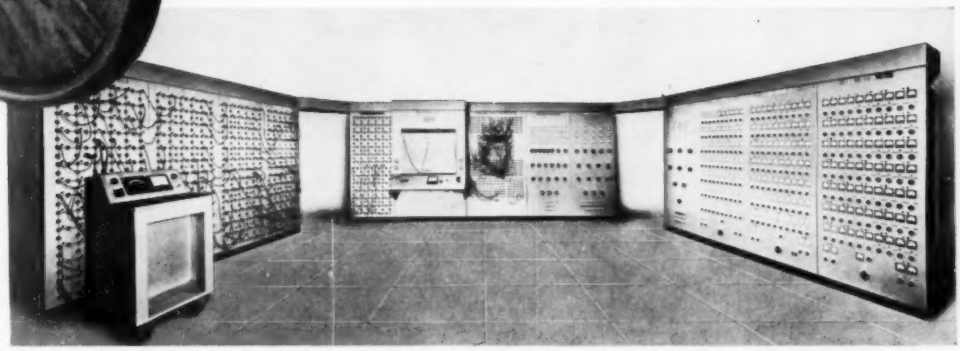

The McIlroy checks with amazing speed the validity of each step in your program of expansion.

THE McILROY FLUID NETWORK ANALYZER SHORTCUTS THOSE ENDLESS SURVEYS, ANALYSES AND CALCULATIONS BEFORE YOU SPEND A CENT!

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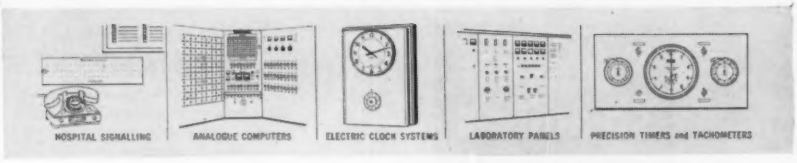

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PENNSALT'S SUPER GAS ODORANT

...puts protective odor where it's needed

In odorizing natural gas pipelines, the ideal odorant must do an adequate job even in small amounts. To afford full protection, it must carry its punch to the *end of the line!*

Pennsalt's 'Sharples' brand Odorant SPOTLEAK® 1009 is noted for its ability to broadcast itself promptly, and direct immediate attention to danger spots in pipelines and mains. This stand-out odorant offers many exclusive advantages:

- it guarantees 80% minimum tertiary butyl mercaptan content.
- its odor is far-reaching and unmistakable.
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- it assures less oxidation loss and delivers more odorant AT THE END OF THE LINE.
- it possesses the highest perceptible and warning level of mercaptans, introducing definite and continuous protection.

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Plastic tubing of Tenite Butyrate makes natural gas service replacements easier—and more economical. This tubing eliminates the need for trenching—the most expensive operation in service replacements. Only two holes need be dug: one near the gas main tap, the other at the service riser. Tubing of Tenite Butyrate is then run through the corroded metal service line. Since plastic creates less friction than metal due to the smoothness of its walls, pressure is unaffected by the slight decrease in diameter of the service line. Easy-to-use adaptors make connections between tubing and metal pipe.

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The economy does not stop with installation, however. Tubing made of Tenite Butyrate withstands soil corrosion or electrolysis—so you are assured of many years of trouble-free service.

Since 1943, extensive field use has demonstrated the many advantages of Tenite Butyrate over metal for natural gas service. One company has already installed nearly 3,000,000 feet of Butyrate tubing—for both new and replacement service lines.

Discover how you can share in the benefits offered by this Eastman plastic. At your request we'll send more information about the tubing, fittings, and their installation, plus a list of suppliers in your area who handle tubing made of Tenite Butyrate. Write: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

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Polyken No. 920—20 mils, thick and tough for heavy-duty use on straight runs, yet it's conformable, too.

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Only if you use a *Polyken* polyethylene tape on *accessory* jobs are you getting the most for your money

Whatever your need in accessory tape coatings, you will find a *better* solution at *lower* cost with one of these Polyken tapes.

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Why Polyken? Because only Polyken has successfully developed the complete line of polyethylene tape coatings. And no other tape coating—*absolutely none*—can match the remarkable properties of Polyken polyethylene:

- **tough and elastic**
- **unplasticized, non-drying film**
- **doubly thick adhesive to seal all voids**
- **far higher adhesion for a true bond to pipe surface**
- **lower water vapor transmission rate**
- **higher electrical insulation resistance**
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Compare the cost of each Polyken tape with that of the competitive tape it surpasses in performance. Here is your Polyken distributor . . . contact him now.

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Tulsa, Okla.: William Cluff Corp.
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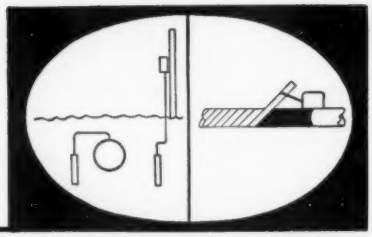

An evaluation program for service line coating

By MARSHALL E. PARKER

THE problem of comparative evaluation of pipe coatings by actual field test is a complex one. In the laboratory, all of the factors except the one under study can be controlled; but this very act of control introduces an artificiality into the test conditions which puts the results under suspicion. In the final analysis, the only fully reliable test for a coating is its performance under field conditions, for a period comparable to expected useful life.

But, since no two lines can ever be said to be under identical exposures, how can we gain assurance that comparative tests of different coatings, necessarily on different lines, are valid? The answer lies in a statistical approach—there is safety in numbers—but at the same time, all possible variables are taken into account. The following long-range program for a distribution system, is an example:

(1) *Scope of test.* All new domestic service lines are to be tested. All existing services are to be tested when, for any reason, it is convenient to disconnect or insulate them from the main. In addition, a selected number, to be designated from time to time, of existing services are to be tested. For the most part, this group will be tested in connection with the scheduled meter testing program.

(2) *Test method.* With the service line disconnected at both ends, a small current, ΔI in milliamperes, is drained from the service line to the water piping system (normally this can be done at the regulator, since the gas piping is usually connected to the water piping through the water heater). As this current is interrupted, pipe-to-soil potentials are read with the potentiometer connected to the (free) end of the service nearest the main, the electrode placed directly over the service, as near its midpoint as practical.

The *charge* in the pipe-to-soil potential accompanying the interruption of the test current is designated as ΔE (millivolts). A set of increasing values of ΔI should be used until a value of ΔE is obtained between 100 and 400 millivolts.

The soil resistivity is measured near the midpoint of the service line, using the 4-point method, with a pin spacing of 5 ft 2 in. (This value gives a multiplying factor of 1000.)

(3) *Other data required.* On each test sheet, information is to be recorded covering: the length and diameter of the service line; kind of coating; whether mill or field coated; date of installation, if known; date of mill coating, if known, or approximate time lapse between coating and installation; location and date of test, name of employee testing, instruments used.

(4) *Calculations.* The total conductance of the service line, in micromhos, is given by

$$K = \frac{\Delta I}{\Delta E} \times 1{,}000{,}000.$$

This quantity, divided by the length of the line, gives the conductance in micromhos per foot. The basic data from each test, to be tabulated and used in the analysis, consist of:

(a) Identification and age of coating.

(b) Leakage conductance, micromhos per foot.

(c) Soil resistivity, ohm-centimeters.

(d) Diameter of line.

(e) Identifying number of test, for reference if needed.

The value of such a testing program will develop slowly, with the accumulation of a sufficient number of tests to be of statistical significance. In several years' time, the information gathered should shed valuable light on the performance of all types of coating in extensive use within this particular system. Where a certain coating specification has been used for a number of years, the results of a few hundred such tests, carried out in a very few months, covering services of all ages, can be used reliably to evaluate the coating over a long span of time. The large number of samples for each age will validate conclusions, although the exposures are not identical.

It is planned, when a sufficient number of tests have been made, to assemble the data on a set of punched cards, so that correlation studies can be carried out by the use of computing machines. Comparisons can be made among numbers of services of similar ages, with the same coating specifications, but lying in different soils, to check some theoretical considerations concerning the effects of soil resistivity on measured leakage conductance. Once this is established, it will be possible to make comparisons over wide ranges of time and of exposure, between coatings of all kinds.

Even before this correlation is established, it will be possible to select groups of services lying within narrow ranges of soil resistivity, and from them to derive useful conclusions between different coatings. ■

Built to "take it," this low-cost Barber-Greene Ditcher cuts the cost of digging narrow trenches . . . proves that hand digging is no longer economical, even on the smallest jobs.

Digging from house to main at less cost than ever before

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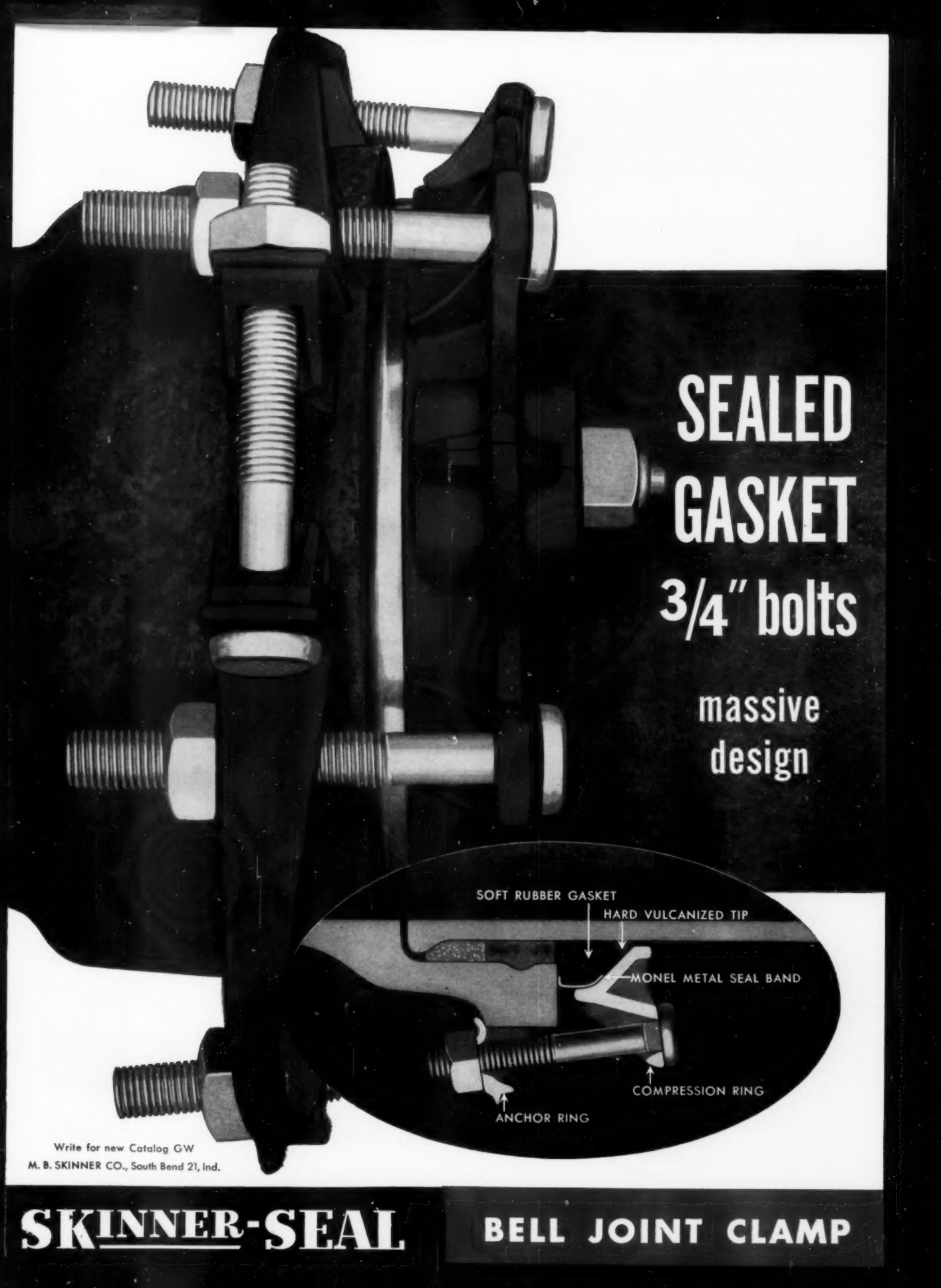

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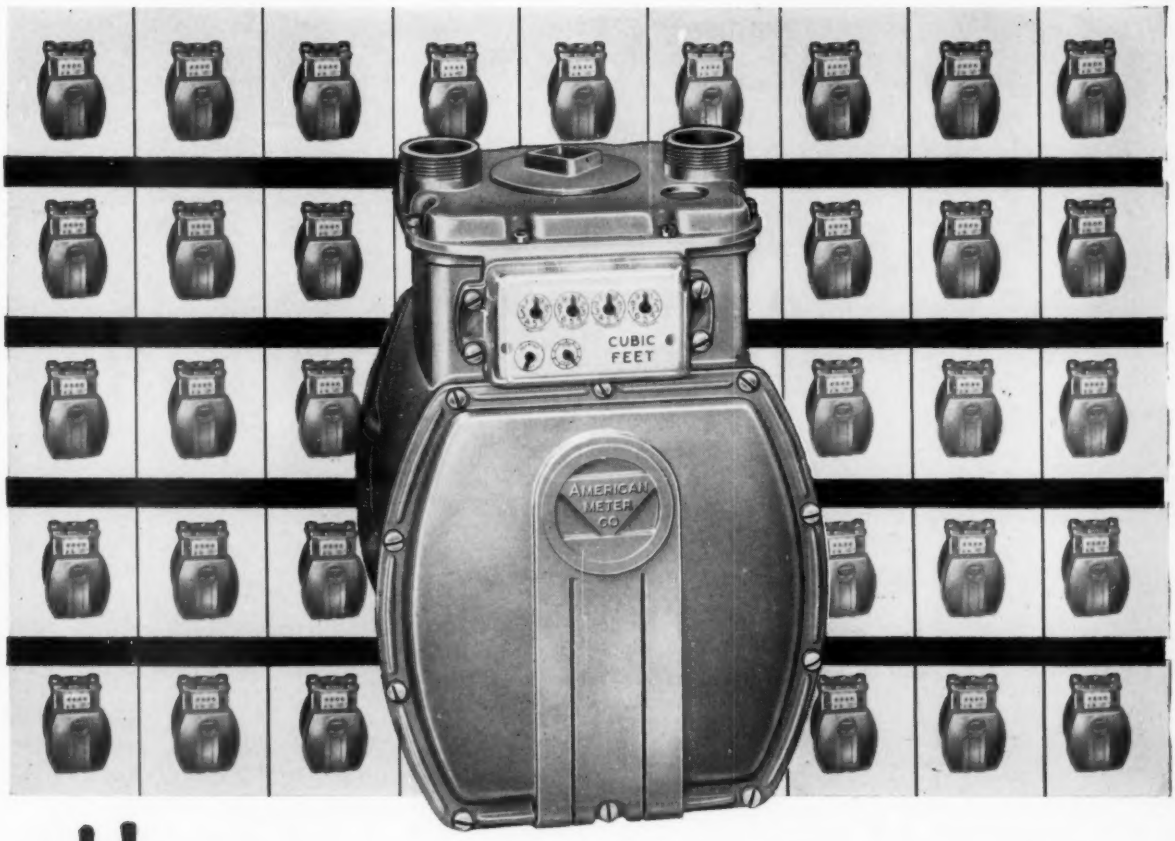

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JULY 1957

Boston Gas Co. uses new technique for conversion

Boston Gas crewmen perform a typical purging operation. Stack controls and test burner are kept away from the flare.

By H. BROWN BALDWIN and JOHN T. McKENNA, Boston Gas Co.*

CONVERSION to natural gas has become an old story with practically every gas utility in America. Natural gas has reached nearly every portion of the country. Among the last of the areas to be reached was New England when in 1952 and 1953 two major pipelines were extended into the area from New York and New Jersey. Every company within reach of these pipelines switched over at least partially to the new fuel.

Boston Gas Co., largest in New England, found itself in an economic position which favored partial rather than full conversion. When gas first entered the area, Boston Gas converted to straight natural gas in what was then called the high - pressure district. This involved about 6,000 meters. Though the land area was quite large the customer saturation was low and, as a result, only a relatively small number of customers were converted. The economics of the situation, however, were decidedly in favor of such a move in that costly pumping operations were stopped.

The major portion of the Boston Gas system was placed on mixed gas. The original gas had been 528 Btu cu ft at about 0.500 average gravity and with the advent

*Mr. Baldwin is distribution planning engineer, and Mr. McKenna staff engineer.

of mixed gas in September 1953, the Btu was raised to 581 at a gravity of about 0.600. In August 1955, the Btu was raised to 610 at 0.600 gravity. These changes on the basic gas of the system were made in accordance with the suggestion of M. Frank Knoy, assistant vice president and chief technical engineer. His recommendation was based on his basic therm and gravity relationship formula which has become well known throughout the industry. Certain fringe appliances were readjusted in the course of normal service work and the rise of 82 Btu was accomplished without conversion.

By 1954 it became apparent that the Old Colony division, which comprised some 21,000 customers, was reaching the limit of supply afforded by the existing transmission line from the main plant. Careful study showed that in 1955 a 0°F day would necessitate propane-air peak shaving in the division. The company did not feel that it was ready to go to the expense of a conversion in that division in time for the 1955-56 loads. As an interim move it was decided to have a small group of conversion men convert the central heating and kitchen heating customers to take a proposed peak shaving gas. In this way, it was felt that the company would be able to prepare its heating equipment for the eventual use of natural gas and yet delay the actual conversion at least one and possibly two years.

As a matter of policy all of the gas appliances in the homes of the various heating customers were drilled to a port size sufficient to take straight natural gas when it came. The orifices, however, were sized to give proper input on the basic and peak shaving gases. The completion of this work in 1955 partially prepared some 3500 customers for the eventual conversion. A careful study of the November and December sendouts in this division in 1955 indicated that conversion could be delayed no longer than one winter.

Early in January 1956 a small group of Boston Gas employees were assigned the task of effecting the conversion in the summer of that same year. In many respects this conversion was organized and expedited in much the same manner as hundreds of others throughout the country. But, in some respects, the problems that were encountered were peculiar to this one job. Certain ramifications might be of interest to readers who are contemplating conversion work in the future and the authors, therefore, offer their experience in the hopes that their findings may be of some help as the findings of many other companies helped them. In the course of this changeover a new technique for conversion to straight natural gas was developed and successfully applied to an area of over 5000 customers. This particular technique is perhaps the most important development of the entire operation. It will be discussed at some length later in this article. But to get a full understanding of its import, one must understand the background leading up to its evolution.

The conversion organization was basically set up in three groups. The first group, which was the customers' premises group, was to be responsible for the appliance surveys, procurement of parts and material, the development of conversion specifications and the inspection of the actual conversion work in the customers homes and places of business. The second group was responsible for the preparation of the distribution system. This entailed the installation of division cocks and purging points as well as the operation of various tests where mains not normally used as major feeds were

Boston Gas conversion inspectors gathered each morning for brief discussion and, naturally, cup of coffee, before starting work.

The shop truck (left) was equipped to drill difficult burners and make repairs. The stock truck (right) served as a mobile supply center.

pressed into service due to sectionalization. When the time came this same group was responsible for the sectionalization and purging of areas with the admission of natural gas. A third group was set up to determine the most feasible zones and the procedure to be followed in purging out the system. It was also this group's job to design and test purging equipment, to supervise tests in the areas, to determine locations for cocks and blow-offs and direct the purge crews by radio during the actual purging work. This group was also held responsible for the development of maps for the use of purge crews, conversion men, company supervisors, advertising and executive groups.

These three sections worked directly with the field coordinator, who acted as liaison between various company groups and the contractor. He reported to the coordinator daily giving verbal progress reports and discussing overall policies. In this way the coordinator was able to give more time to his other duties and yet be in constant touch with the field work. As mentioned, a contractor was employed and in the first week of April he moved into the area with about 55 men. The force was built up eventually to nearly 90 men and then tapered back to around 70. The wage rates were set by contract as were several other facets of the job. In general the contract was similar to many others for conversion work. Conversion crews were made up of from eight to 10 men and were accompanied by an inspector from the company. A new chief was in charge of each crew and he reported to the contractor's general foreman.

The field office was established at 80 Pond St., South Weymouth. This acted as a records headquarters and a special office for conversion calls from customers. Six complaint phones (with 15 lines each) and three contractors' phones (with 1 or 2 lines each) were installed. Furniture was borrowed from active, surplus and to-be-abandoned stock. In every case, aside from file cabinets, no furniture of particular value was used in the field.

The shop and stock trucks were fitted out by the carpenters, electricians and the transportation division. Space limitations were noticeable but under the circumstances not unbearable. Portable electric power was available but the group made arrangements to buy power at convenient gasoline stations. This also enabled the fleet to refuel on a standing purchase order basis.

A somewhat elaborate system of forms was developed to control the work on customers' premises. In addition to the use of several standard company forms, a special gas conversion series was issued. There were at least 18 special forms in use. In general there were two identical files. The company maintained one and the contractor the other. Control cards never left their respective files but work orders, memos and tag stubs were alternated back and forth as work was dispatched and completed. The files were set up in conversion zones alphabetically by streets and by street numbers within the streets.

An exception to this routine was made in the case of section 22. This section, which was primarily Cohasset and Hull, was converted by a different method than that employed in section 1-21. Being an area of some 5000 customers and no "make safe" visit required, it was more expeditious to use meter routes as dispatching boundaries. These files were set up by meter routes to conform.

Approximately 45 division cocks

Conversion technique . . . All purge movements were radio controlled

were needed in the job and well over 1000 blow-offs. The blow-offs were installed with contract and company labor. The work was started in 1955 but nothing in the way of production installation began until early in 1956. The early March snows of that year threatened to sabotage the project but the first sections were completed in time to start a month ahead of early planning. Subsequent sections were done ahead of the conversion crews by working "off" days on blow-off installation. "Turn-in" days were normally Monday, Wednesday and Friday.

The start of work on a "turn-in" day was 6 a.m. and burners were lighted at 7 a.m. All purge movements were radio controlled and the base stations maintained silence until the purge operation was completed. This normally ran to 10 or 11 o'clock. Service division radios were left on but men called in by phone for their work.

In an operation of this nature it is of certain help to have advance knowledge of the type and magnitude of work to be encountered. In the Old Colony area this presented some difficulty. A lack of applicable records led to a decision in 1955 to make a postage paid return card survey. This card with an explanatory letter was mailed to these south shore customers on May 6, 1955. The results were quite helpful. The residual information was gathered from a ticket survey of 1955 work, Old Colony Gas Co. records, current service work and estimates. Much of the parts ordering was done on the basis of this advance information.

The method of conversion of appliances has been, is, and always will be, a point of much contention. Certain appliances lend themselves easily to conversion while others necessitate considerable alteration. Each conversion company follows certain practices which are generally peculiar to only themselves. Boston Gas Co. is not an exception. The information gathered from countless trial and error experiments in the 1953 conversion proved invaluable in the 1956 work. Laboratory tests, field work and a careful survey of the general practice manuals of established companies added to the pool of information.

Early in January of 1956 the conversion "customers' premise group" began work on a Boston Gas Co. manual. The manual was made up in an 8½ x 11 size and loose leaf bound. Changes could be made from time to time and lost pages replaced. Printing was done by multilith. When completely assembled it contained over 240 pages. Each manual was numbered and issued. They remained Boston Gas Co. property.

In every case possible, the appliances were brought up to rated input. In some cases it was impossible to obtain ratings and still maintain proper flame characteristics. In such cases, though, the customer was informed of the problem and the sales department was called upon to "trade out" these questionable appliances. A successful program was experienced along these lines.

In any conversion to date, a major question prior to field work has been how many jobs will we complete per day? It boils down to the number of jobs per man per day (average) that makes the total. In any event it is a hazy sort of figure with which one must work. Many factors enter into the analysis and most of them are evolved by studied judgment only. The average jobs (accounts) completed ran about 310 per day on predrill. It is of interest to note that it was three weeks before the group broke the 300 mark steadily. It appears, however, that the average ran about 4.75 jobs per man per day.

An inspection policy was set up prior to actual field work. In view of the fact that our specifications were somewhat more stringent than those to which some of the men were accustomed, it was felt that some form of follow-up inspection should be made. The inspectors would be servicemen, most of whom had been on the conversion in 1953. It was imperative that these men be flexible in their thinking and abilities as the type of job indicated that many diversified chores might arise.

The force selected for this work was made up of eight servicemen and an inspector. A tenth man was taken on to act as stock man and aid in setting up the shop and stock trucks. Another man was supplied by the commercial and industrial sales division to follow the work on commercial and industrial appliances. This man also acted as contact with those customers using such equipment and established schedules for them so that they would have a minimum of inconvenience.

About 10,119 accounts were inspected. Of this amount 1638 were sent back for re-working by the contractor's forces. This represents just over 16 per cent turned back. The full tally is shown in *Table I.*

No particular problem seemed to be paramount with the crews. Very seldom was it possible to state that a given appliance, part, control or burner was giving continued trouble. From time to time

TABLE I. REPORT OF INDUSTRIAL AND COMMERCIAL ACCOUNTS INSPECTED.

Period & Sections	Accounts Inspected	Accounts Found Faulty	% Inspected Found Faulty
Predrill 1-21	3,049	439	14.4
Conversion 1-21	3,861	753	19.5
1st & 2nd Steps-22	3,209	446	13.9
Totals	10,119	1,638	16.2%

certain items would give trouble in general but as soon as corrective measures were found the problem seemed to subside. It can be safely concluded, however, that flame adjustment to Boston Gas specification was more difficult for the crews than the drilling.

Included in the job was the customer notification and advertising program. The notification was made through two letters and a personally delivered handbill. The first letter was mass mailed to the Old Colony area about March 23. An explanatory pamphlet was mailed along with this letter giving some basic instructions on flame characteristics, costs of conversion (by whom) and reason for conversion.

The second letter was staggermailed by zones roughly a week before natural gas was to be turned in. Two or three days before the actual turn-in a handbill with the exact conversion date stamped on it was personally delivered. In every case an attempt was made to get the handbill directly into the hands of the customers. A copy of this handbill was included with the second letter (without the date.)

A third or follow-up letter was sent out to the customers approximately a week after conversion. A postage-paid return postcard was included on which the customer was invited to note any further adjustment which they felt should be made on their appliances.

The first preliminary thinking on conversion called for sections that could be handled in one day. This led to a section of about 400 customers. As early plans were changed, however, the sections were enlarged to 1000 customers. Excessive preliminary street work, more or less, forced the decision in favor of as large a zone as possible to reduce the number of division cocks. Tempering this trend was the size of a contractor's crew and the probable increase in purging personnel necessitated by large zones. The mean of 800 was eventually chosen as this represented two days work for the available manpower.

A general lack of large scale maps and sectionals in the area to be converted posed a difficult problem to the mapping section. Meter routes were used to determine the customer concentrations. The zoning presented problems of the usual nature but eventually a feed problem developed for some 5000 consumers. The area affected was primarily the towns of Cohasset and Hull as shown on *Fig. 1.*

Fig. 1. Map shows Boston Gas Co.'s customer concentration in towns of Cohasset and Hull.

Hull posed a particularly tough situation for the zoning group. A single feed main ran the length of the town but looping mains were too small to give a back feed as the town was sectionalized. The conversion zones having been established at about 800 customers in size led to a breakdown of Hull and Cohasset into four or five zones. Three of these would be in Hull. In 1953 a similar situation on a somewhat smaller scale led to the purchase of a portable propane-air plant. This plant could be used to solve this situation except that pressure tests showed that a main formerly considered adequate to back feed Cohasset during conversion was inadequate. The load that this additional area would place on the portable plant was greater than the plant's capacity. There could be no chances taken on determining the conversion method. The summer colony of Hull made it imperative that the solution be capable of withstanding peak July and August loads. Furthermore, the method evolved would have to get the conversion crews out of the area by Labor Day as on that day nearly 1500 consumers would leave for winter homes and the C.G.I. problem would be nearly impossible to control. Relaying of mains was considered but cost as well as time ruled that solution out. A temporary line layed on the beaches was considered and additional vaporizers, jets, and tanks were talked of for the portable plant.

All known answers to the problems seemed either too time consuming, dangerous, costly or otherwise impractical. Eventually, however, the company's combustion laboratory came up with the answer.

Solution consisted of a two step conversion using two interim gas mixtures. Appliances with port burners were drilled to a standard 20,000 Btu/hr/sq in. of port area, or as close as the physical dimensions would allow. All ribbon and other special types of gas burners were changed to their natural gas counterparts insuring sufficient port area for hard flame settings on the adjustment gas. At the time of the drilling all appliances were re-orificed for a 770 Btu gas while burning the first interim mixture of 650 Btu gas.

This orificing left appliances a little better than 15 per cent undergassed. At the same time flame settings were made on the hard side of normal +2 on AGA standard (softest setting permissible +1 if necessary to insure ignition.)

When the above work was carried out on all appliances in the area to be converted, the sendout Btu in the plant was increased to 885 Btu, 0.605 specific gravity by cold enriching the 650 Btu gas with additional straight natural gas to 885 Btu. This resulted in a mixture of about 37.5 per cent Boston Gas central system 610 Btu output gas and 62.5 per cent straight natural gas. The appliances at this stage were about 17 per cent over-gassed. This mixture contained about 7 per cent H_2. With this percentage H_2, it was possible to set hard flames again at the 885 Btu (+2) level so that normal flames would result when natural gas was substituted.

With the substitution of the 885 Btu gas, very few additional complaints were received above the normal level established during the conversion period. The only complaints that did occur were easily handled by the normal complaint force. These were divided almost entirely into two classes:

Poor Adjustment: If the adjuster, when respudding the appli-

P. F. Williams of Boston Gas directs purge operation by two-way radio. Use of mobile center facilitated the operation and overcame any local transmission problems which might have prevailed with the base stations.

TABLE 2. SENDOUT GAS DATA.

	Output Before Conversion	First Adj.	Second Adj.	Final Stage
Btu	610	650	885	1050
Sp. Gr.	.605	.605	.605	.605
% Therm Input based on 581 BTU *	104.5	111.5		
Based on 770 BTU Spud		84.6	116.7	
Based on Natural Gas Spud			84.5	100
Typical % H_2	23.3	20.9	7.2	0%

* 581 taken as base since most appliances adjusted at this point.

TABLE 3. GAS ANALYSIS.

Analysis	Output Before Conversion	First Adjustment	Second Adjustment
CO_2	1.5	1.3	1.1
Illum.	1.7	1.9	1.1
O_2	4.1	3.0	0.3
H_2	23.3	20.9	7.2
CO	4.9	4.3	1.0
C_2H_6	44.6	1.7	3.0
CH_4	1.9	48.6	75.4
N_2	18.0	18.3	10.9

ance, failed to adjust the top pilot on the range to the lowest workable setting, odor complaints resulted when the higher Btu gas was substituted. This odor was the result of the higher yellow flame standby pilots impinging against the range tops. If a proper adjustment had been made at the time of the pre-adjustment, no similar complaints would have resulted.

Missed Appliances: Because of the nature of the load in this area there were a great number of submetered installations on which no records were available. Although the conversion men were instructed to look carefully for such installations, a certain few had been overlooked. Within one to two days after the 885 Btu gas was substituted, all the refrigerators which had somehow been overlooked and not pre-adjusted, came in as odor complaints.

No serious complaints other than those enumerated above were received.

As soon as the 885 Btu gas had been completely substituted for the 650 Btu gas, the conversion men were sent into the field to make the final adjustment for natural gas. All appliances were again re-orificed (fixed orifices.) This time for natural gas (1050 Btu 0.60 sp gr) and the flames again set hard (+2); the sendout still contained 7 per cent H_2 at this point. This fact along with the pre-drilling of the appliances to a standard 20 MBtu/hr port loading enabled the flames to be set hard enough so that when the natural gas was substituted a normal flame resulted.

When the natural gas was turned in just before Labor Day, there was hardly a single complaint about the new gas. Thus we were able to go from a 610 Btu sendout gas to 1050 Btu natural gas with only two visits to the customers' homes.

There were a few appliances which presented out of the ordinary conversion methods which are outlined here:

All Servel refrigerators on the first step were changed to mixed gas specification (No. 368 Servel burner.) This was used instead of a natural gas burner because the natural gas burner was found sensitive on bypass with an undergassed condition.

When natural gas was turned in, a few high input refrigerators were changed to a natural gas specification (No. 367 Servel burner) to eliminate yellow tipping. Since our records were up-to-date as to location on these units, it was a fairly simple job.

The other appliance that gave some trouble was the Burkay water heater burner. The manufactured gas burner was revamped to increase primary aeration at the first adjustment and at the second adjustment a natural gas burner was substituted.

Certain commercial equipment, especially broilers and fryers, had to be set at rating on the initial adjustment at each step. This resulted in an overgassed condition when the new gas was substituted. This, however, did not result in any complaints since as a matter of record the majority of commercial equipment visually controlled ran from 25 to 75 per cent overgassed

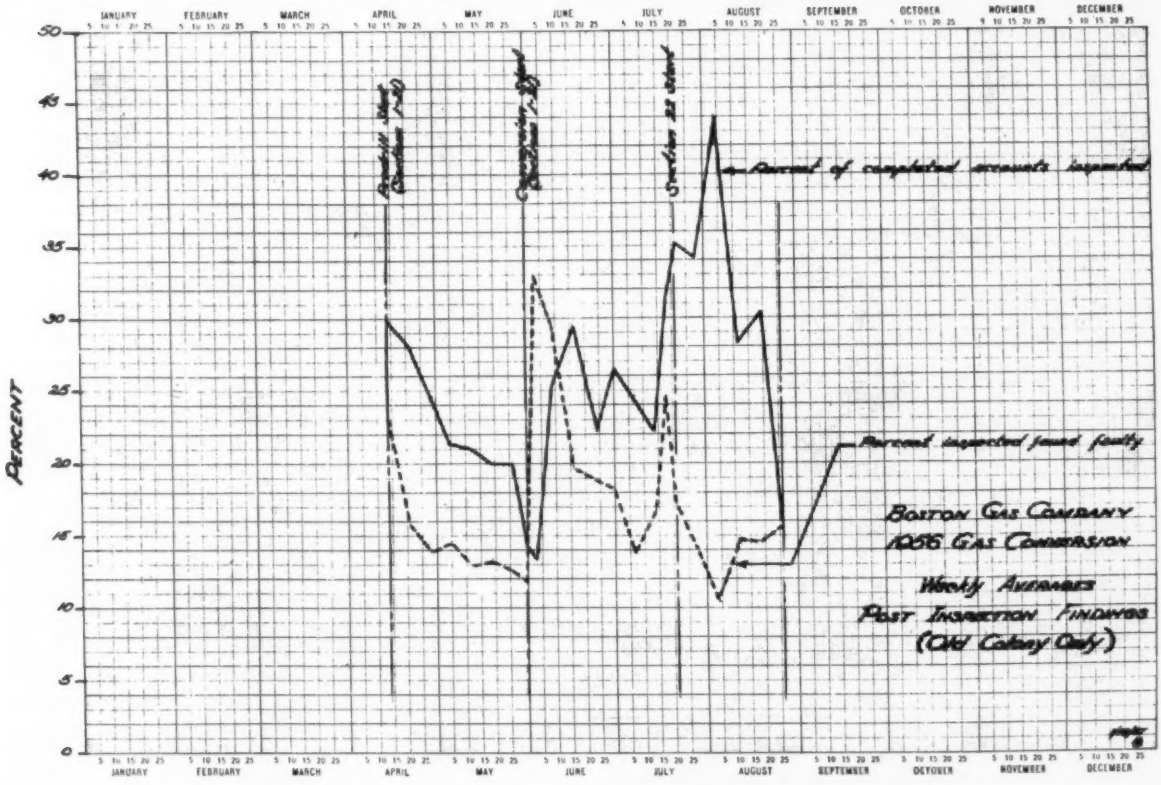


Fig. 2. Graph shows weekly quality inspection findings in Old Colony section.

Natural gas goes on in the first section. Shown left to right are: M. F. Knoy, assistant vice president; H. B. Hollis, chairman, board of selectmen, Braintree; A. W. Johnston, vice president; H. R. Condon, assistant vice president, and J. J. Quinn, vice president.

as a normal procedure. No trouble resulted from our slight overgassing and very few complaints resulted from the "undergassing" when commercial appliances were adjusted to about 15 per cent above normal. Commercial appliances, however, were not overgassed unless hard (+2) flame settings could be obtained with the overgassed burner.

Tables 2 and 3 give detailed gas specifications used in this conversion.

Now then, how did it all come out? Without hesitation we can say reasonably well. The majority of the customers were done in the "standard" fashion as the new "two step" method was untried. Though we had faith enough in the findings of our laboratory the mechanics of doing the entire area by this new method were tough to handle. The plant would have to be producing three kinds of gas at once and with only two sendout lines, no mixers, one holder and standby for only one gas at a time it seemed feasible to do as many customers as possible by the standard system. This meant 21 sections in the conventional manner and one large section—section 22—by the "two steps."

It is important to consider five major factors: speed, control, quality, customer reaction and cost.

The consideration "speed" is of variable importance. In some cases the overall length of the job is important whereas in other jobs the length is secondary and emphasis is placed on jobs per man per day. This latter factor is, of course, common to all methods but not necessarily paramount. In the Old Colony case both factors were of serious importance. To get the number of men necessary to cover 800 customer sections it was necessary to hire early and put to work early. On the other hand it seemed that the number of men might be too great and the job all together too small. This could result in a prolonged stretchout. It was decided, however, to perhaps sacrifice hourly efficiency to gain a large enough crew. The section size was limited by the capabilities of the street division in preparing the sections for feed and shut down.

In general it can be said that the standard conversion gets more accounts done per hour. This is a slightly theoretical conclusion but is based on the reasoning that the two step requires the adjuster to do everything that is required in the second visit of the standard adjuster plus a spud change. The adjuster is also required to set his flame on the extreme "safe" edge of the tolerance band with excess air. The standard adjuster can get a flame that "looks good" and feel assured that it will continue the same as the gas is not to be

TABLE 4. COMPARISON OF STANDARD VS. TWO STEP CONVERSION.

	"Standard"	"Two Step"
Speed	faster*	slower
C.G.I. problem	less*	greater
Timing	important	less important
Advertising	greater	less*
Control of men	less	greater*
Accounting control	problem	less problem*
Quality of work	reasonable	reasonable
Customer reaction	reasonable	reasonable
Company personnel required	greater	less*
Cost	(about equal)	

changed. Ignition is easier on the two step due to the residual hydrogen of the interim gas. This speeds the second visit only at the expense of possible poor ignition on natural gas and third visit. To date a satisfactory approach to commercial accounts has not been developed other than to "sit with them." Refrigerators gave less trouble than was anticipated and it is expected that in the future they can be pre-adjusted satisfactorily. The third visit to certain accounts, however, tends to make the job longer in the two step case. This theory was substantiated by field experience.

Bear in mind that the summer colony nature of the Hull area made C.G.I. accounts a problem. It is felt, incidentally, that C.G.I.'s would be a bigger problem in the two step anyway in view of the "low pressure" approach to cooperative action. On the other hand there were no house heaters involved in section 22 insofar as the contractor was concerned. Company personnel managed to take this problem unto themselves. At least two days were effectively lost in the second gas change of the two step. This is due to the chasing of delinquent C.G.I.'s on the day before and sitting with the commercial accounts on the day of the gas change. This loss has to be considered.

All in all it appears that on a job/hr basis the two step is about 15-20 per cent slower than the standard though these figures are presented with full realization that some fairly valid rebuttal statements could be made.

Control is a factor in which it is anybody's call. Under the organization which our contractor maintained the control of certain groups was difficult. It is the writers' private opinion though that except for the two or so days involved in changing gases, the two step gives a better control of the field action. Dispatching is easier (by meter routes), the crew works in a small area under direct supervision of his crew chief. Experts or specialists can be better contained within smaller areas. "Jumping" of men from crew to crew is not as necessary and "tough" problems can be scheduled for the specialist concerned. The inspector is not used for turning off C.G.I. supplies and can devote his entire time to inspecting and aiding the crew chief or chiefs. Fewer inspectors should be needed, though in this case we were in such a position as to make maximum use of each man.

Conversion technique . . . Regardless of method, the quality is about constant

Of possible major concern in a larger conversion would be the accounting control. With the conversion forces working by meter routes the billing could be stepped along with the work. This was not possible under the standard method. Automatic accounting machinery can also be applied to give more accurate, faster and less expensive office control. Cost analysis is more accurate and can be predetermined with more assurance of being correct. The two step is a steady day-by-day process and the 12, 13 and 14 hour "blitz" days are eliminated.

The quality picture is pretty well shown in *Fig.* 2. The quality seems improved in section 22. That is not all fact, however. In the two step method the inspector is not able to observe the ignition and final adjustment. The complaint picture isn't much of a help because of the customers in section 22. Soon after natural gas was introductd a large portion of the public moved to their winter quarters. Here we must wait and watch. Many observers seemed to feel that the work was below par in this area though the facts as recorded don't seem to substantiate it. The reasons being what they are, however, leads to a fairly safe feeling that regardless of method the quality is about constant.

Customer reaction is important. Hull and Cohasset accounted for 19.4 per cent of the customers and 20.8 per cent of the phone calls to the field office. These towns, though, made 29.3 per cent of the *complaint* calls. There may or may not be psychological reasons for this. The "aggravation index" is not conclusive but the complaint calls per complaint reached a peak of 2.56 (from a norm of about 1.3) and the return post cards ran 1.199 complaints per card as against 1.17 for sections 1-21. When compared on a complaints per thousand customer basis it appears that there isn't a tremendous indication one way or the other. The totals of all complaints were very close but the two step area seemed to be a bit more spread out in nature of complaints. The range complaints seemed to be lower allowing more complaints to be spread about other categories. Section 22 had a range saturation of 114 per cent.

Cost is a difficult analysis to make. We can only draw certain conclusions from what is indicated. The rather comprehensive accounting system set up for the conversion did not cover the two methods in separate breakdowns. The field division of charges would have been too difficult to make with any accuracy. The figures given for the area, however, can be separated with reasonable and judicious ease. The results indicate that each method cost about as much as the other. The two step uses more stock and labor in the houses but practically eliminates street sectionalizing and purging work. In a heavily congested area as in a major city it is easily seen where the high cost of division clocks and purging would far outweigh the higher labor cost inside. On the other hand the more rural an area might be the more feasible the standard method would become. It is obviously a method for a particular case but the case may be widespread.

To bring this discussion together into a compact analysis, Table 4 is shown. The comments or ratings here are primarily the writers' and open to some question where opinion has been a major basis of discussion. The asterisk shows the favorable situation. On the "asterisk basis" it appears that its "two step more than two to one." The ratio may be off but the choice seems correct in this case. ■

GAS LOAD CONTROL through telemetering

By R. D. HAYS • Illinois Power Co., Decatur

THE extraordinary growth of the gas industry during the past 10 years has surprised the executive leaders of utility companies. This growth has converted management opinion from extreme pessimism to optimism about the future development and earning power of gas, one of the nation's oldest industries.

Underlying this growth is the widespread transmission and use of natural gas. Pipelines bring this wonder fuel to city gate stations of distribution companies. The local utilities accept the gas and in turn deliver it to millions of ultimate customers. The demands of these customers seem insatiable and the effort to meet these demands is accompanied by tremendous problems.

Illinois Power Co. purchases natural gas from four pipeline sup-

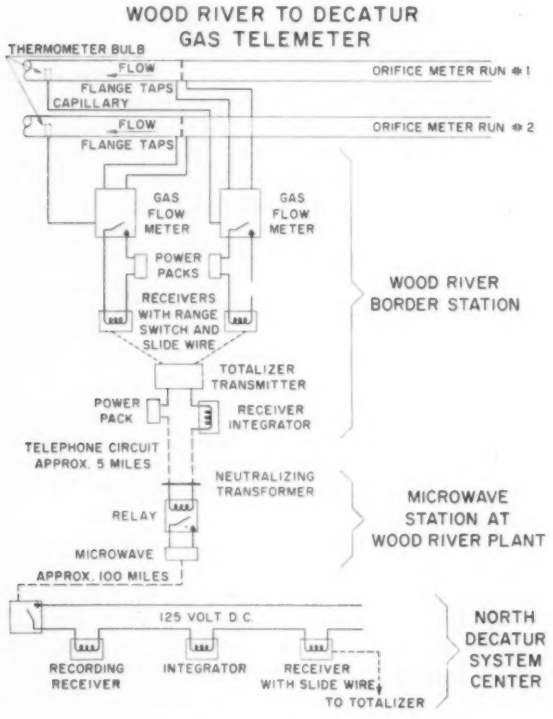


Fig. 1. Typical border station installation with connection to a microwave station and distant receivers at Decatur.

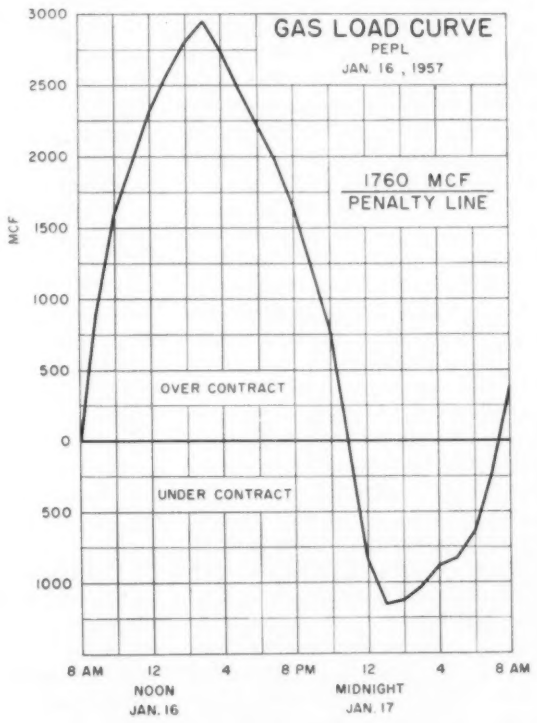


Fig. 2. Actual flow data plotted for a day approaching maximum conditions.

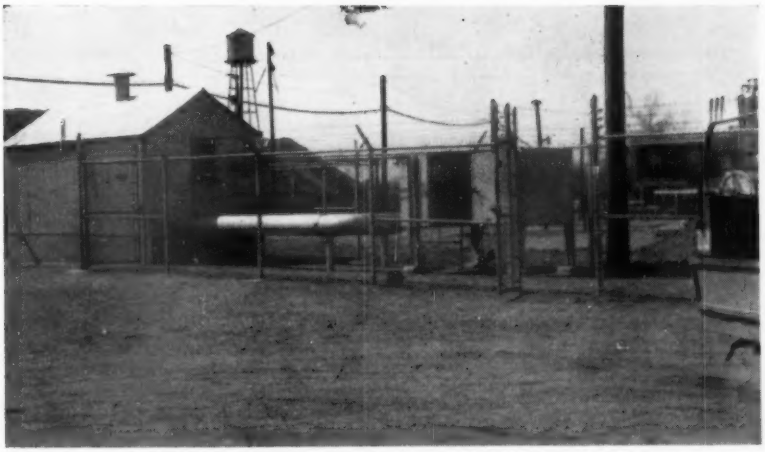


Fig. 3. Granite City border station showing pipeline building and Illinois Power's cabinets for telemetering equipment.

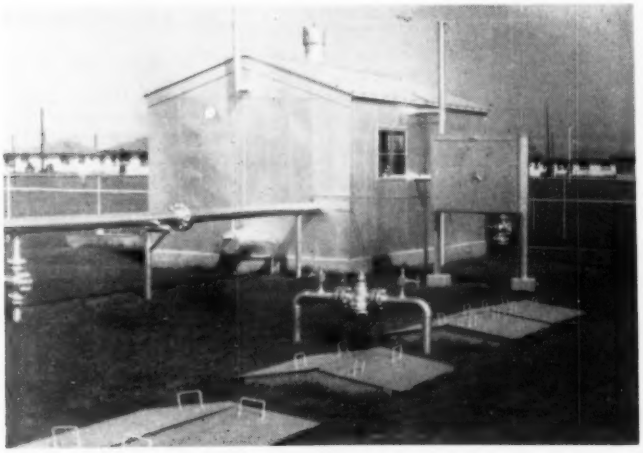


Fig. 4. At the Hoffman station, Illinois Power receives gas for delivery to the Mt. Vernon service area.

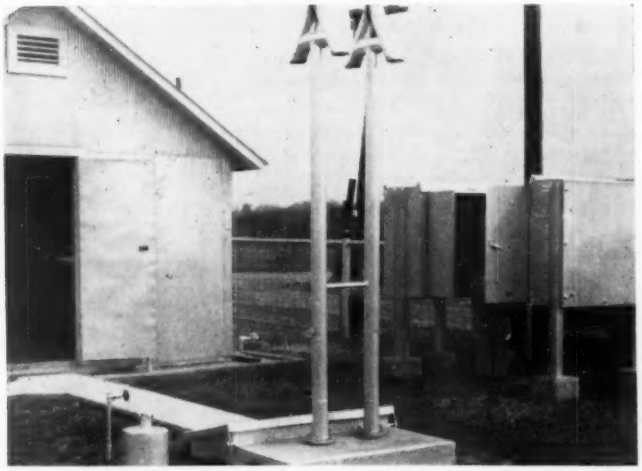


Fig. 5. The cabinets at right hold telemeter equipment for measuring gas at the Hallsville station.

pliers for about 175,000 customers including 83,000 space heating, located in 60 communities in the central part of Illinois. These communities vary in size from about 300 population to places like East St. Louis and Decatur, cities of about 85,000 people. The service area extends from Kewanee and LaSalle in the northern part of the state to Centralia and Mt. Vernon, 200 miles south of LaSalle; and from Danville, in eastern Illinois, to Jacksonville, 160 miles to the west.

There is some concentration. For example, East St. Louis, Belleville, and Granite City lie close together across the Mississippi river from St. Louis, and account for about 70,000 customers, all served with natural gas purchased from the Mississippi River Fuel Corp. This pipeline brings gas from the Louisiana fields and Gulf coast area to the St. Louis metropolitan market.

Gas purchased from Panhandle Eastern Pipe Line Co. is delivered to about 75,000 customers in the Jacksonville, Decatur, Champaign, Danville, and Galesburg areas. These cities are somewhat scattered and because of their location are not easily adaptable to physical integration. An advantage from a load standpoint is that, excepting Galesburg, they are almost on the same geographical parallel and thus have about the same kind of weather. Decatur, the largest of these towns, accounts for about one-third of the gas taken from the pipeline, and for that reason is able to influence the deliveries from Panhandle to Illinois Power.

LaSalle and Kewanee receive gas from Natural Gas Pipeline Co. of America.

Mt. Vernon, Centralia and Monticello are supplied with gas from Texas Illinois Natural Gas Pipeline Co.

Another source of supply on maximum days is from the Natural Gas Storage Co.'s field near Herscher, not far from Chicago. Storage gas from Herscher is available only to customers of Natural Gas Pipeline and of Texas Illinois Pipeline Co.

Illinois Power will have a fifth pipeline supplier sometime this year when the town of Cambridge, near Kewanee, is connected to the Michi-

gan Wisconsin Pipeline Co.'s line.

With this diversity of supply and location, along with variables introduced by the weather, it becomes somewhat of a task to exercise a measure of close control over the gas load.

The four pipeline companies deliver gas to Illinois Power through 21 town border stations. In these stations there are 33 orifice meter runs and three positive displacement meters. Telemeter equipment has been connected to 29 of the orifice meters in 17 of these stations. Telemeters will be connected in the other stations when load growth justifies the installations.

Illinois Power began its experience with gas telemetering in 1950 when equipment was installed in the LaSalle station of Natural Gas Pipeline.

It was found that the local gasman was spending most of his time in the winter driving miles several times every day from his office to the border station, reading the orifice meter chart and integrating the readings. If the weather was really cold, he would also check the load at night, trying to find out whether or not he was about to exceed the contract. On some occasions he didn't even go home but spent the whole 24 hours at this task.

It seemed, therefore, desirable to install a flow telemeter to make the job less burdensome and to get data faster and more accurately. Accordingly a transmitter was installed in the border station and a receiver in the local office. This receiver was equipped with a chart for a graphic record and an index so that by reading the index periodically the volume of gas delivered could be determined.

About a year later a similar outfit was installed for Kewanee. In this case the border station is 11 miles from town, and as the gas load increased, the need for telemetering was apparent.

Also about this time the pipeline companies put penalty clauses in their tariffs so that there was a real need to stay within the limits of the pipeline contracts. Therefore a study of the situation was initiated with the idea that eventually gas flow telemetering would become general.

TABLE 1. ACCURACY REPORT NO.

Wood River
Memorandum 2-7-57 Date

1. Wood River—M.R.F.C.—our chart 0–400; Mcf constant for chart is 1.0 and for integrator 1.0.

Date	*Pipeline Total*	*I.P.C. Integrator*	*% of Pipeline*
1–25–57	3766	3760	99.841
1–26–57	3845	3860	100.39
1–27–57	3593	3562	99.137
1–28–57	3311	3294	99.487
1–29–57	3684	3663	99.430
1–30–57	3630	3605	99.311
1–31–57	3162	3126	98.861
Totals	24991	24870	99.516

Latest date of maintenance on equipment was 12–14–56.

Gas Telemetering

TABLE 2. ACCURACY REPORT NO.

Belleville
Memorandum 2-7-57 Date

1. Belleville—M.R.F.C.—our chart 0–150; Mcf constant for the chart is 10.0 and the integrator is 1.0.

Date	*Pipeline Total*	*I.P.C. Integrator*	*% of Pipeline*
1–25–57	13151	13108	99.673
1–26–57	13195	13069	99.045
1–27–57	10535	10592	100.54
1–28–57	11241	11110	98.835
1–29–57	12831	12925	100.73
1–30–57	11953	12062	100.91
1–31–57	10513	10600	100.827
Totals	83419	83466	100.056

Latest date of maintenance on equipment was 1–30–57.

Gas Telemetering

TABLE 3. ACCURACY REPORT NO.

E. St. Louis
Memorandum 2-7-57 Date

1. E. St. Louis—M.R.F.C.—our chart 0–1000; Mcf constant for chart is 1.0 and for integrator 1.0.

Date	*Pipeline Total*	*I.P.C. Integrator*	*% of Pipeline*
1–25–57	3401	*3420	*100.559
1–26–57	3014	3010	99.867
1–27–57	2870	2887	100.592
1–28–57	3175	3186	100.346
1–29–57	3095	3105	100.323
1–30–57	3271	3313	101.284
1–31–57	3251	3282	100.954
Totals	22077	22203	100.571

* Additions necessary due to failure of our equipment or signal. Latest date of maintenance on equipment was 1–11–57.

Gas Telemetering

TABLE 4. ACCURACY REPORT NO.

Granite City
Memorandum 2-7-57 Date

1. Granite City—M.R.F.C.—our chart 0–250, Mcf constant for chart and integrator is 10.0.

Date	*Pipeline Total*	*I.P.C. Integrator*	*% of Pipeline*
1–25–57	31182	30560	98.005
1–26–57	27553	26980	97.920
1–27–57	27966	27260	97.476
1–28–57	29372	28700	97.712
1–29–57	29054	28610	98.472
1–30–57	30548	29650	97.060
1–31–57	29215	28520	97.621
Totals	204890	200280	97.750

Latest date of maintenance on equipment was 1–9–57.

Gas Telemetering

TABLE 5. SPECIAL ACCURACY REPORT NO.

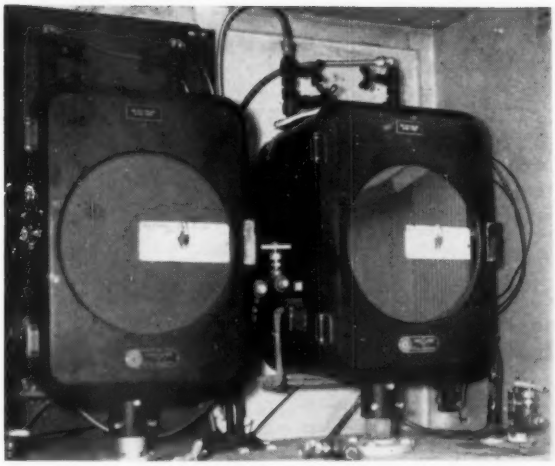
M.R.F.C. Totals
Memorandum 2-7-57 Date

Listed below is a comparison of the sum of gas consumption for Granite City, Wood River, and Belleville as billed by the pipeline with (1) the sum of our integrators for the same location and (2) our totalizer.
E. St. Louis included.

		I.P.C. Integrator 4 Locations		*I.P.C. Totalizer Integrator*	
Date	*Four Locations Pipeline Total*	*Total*	*I.P.C. % of Pipeline*	*Total*	*I.P.C. % of Pipeline*
1–25–57	51500	50848	98.734		
1–26–57	47607	46919	98.555		
1–27–57	44964	44301	98.525		
1–28–57	47099	46290	98.282		
1–29–57	48664	48303	99.258		
1–30–57	49402	48630	98.437		
1–31–57	46141	45528	98.671		
Totals	335377	330819	98.641		

Latest date of maintenance on Totalizer equipment was ———.
Note: Washington Park, and Columbia remain 6% of M.R.F.C. total.

Gas Telemetering



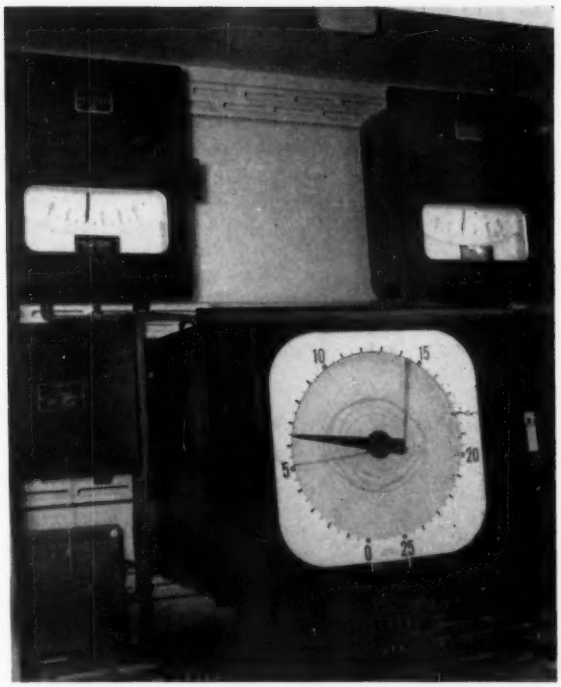


Fig. 6 (above). Ring balance flow meters. Fig. 7 (right). Installation of slide wire receivers, totalizer, power packs, and retransmitting equipment.

Illinois Power was fortunate in that its electric department has been using telemeters for several years. D. F. Hazen, technical consultant to the chief electrical engineer, worked with the company's gas engineers to study the requirements of the gas department; and he greatly assisted in the design, installation, operation and maintenance of the gas telemetering equipment.

Through this study it was decided to use the ring balance type of flow meter and pulse type telemetering equipment, correcting the metered volume for pressure and temperature, and to transmit the data to a distant receiver.

Fig. 1 is a diagram of a typical border station installation with connection to a microwave station and distant receivers in the Decatur system center. The flow meters are connected to flange taps across the orifice plate and are placed at 180° to the pipeline company's taps. A thermometer bulb is installed in each meter run downstream from the orifice plate and is connected to the flow meter by capillary tubing. The differential across the orifice plate and the static pressure are fed into the flow meter and this energy, along with the temperature sensing element is transformed into volume flow data.

These data are transmitted to a slide wire receiver. The slide wire with its calibrating resistors, one set for each orifice size, corrects for average heating value and the numerous other constants injected into the billing formula by the respective pipeline companies. At locations with a single meter run, the flow meter transmits on a 0-100 scale; this must be multiplied by a constant in Decatur to find the Mcf flow.

In a border station with two or more meter runs, using Wood River as an example, each slide wire receiver sends its data to a totalizer which adds the flows through all of the meters in the border station into one figure, thus integrating the data. This information is then transmitted by means of a telephone circuit to the Wood River power station where it is relayed over a microwave system to Decatur headquarters. In North Decatur the flow data are recorded on a receiver and integrated on a counting device as corrected volume in thousands of cubic feet. These data are again transmitted to another totalizer where all of the telemetered flows from the pipeline are recorded as rate of flow. Another counting device is connected with the totalizer so that the entire telemetered volume delivered from the pipeline is integrated into one figure.

It was found that to make the equipment fully effective, the receivers must be attended 24 hours a day, seven days a week throughout the winter season. The integrating cyclometers are read every hour and load curves are plotted for each pipeline supplier as the data are received in the system center in Decatur. Extrapolations are made at intervals to obtain an idea of how much gas will be required for the entire day. If the load forecast indicates that action is required to avoid overrun penalties, orders are sent out by telephone to reduce the flow so as to keep the 24-hour total purchase within the pipeline contract.

In *Fig. 2* actual flow data have been plotted for a day approaching maximum conditions. The pipeline day begins at 8 a. m., with zero volume, and, as the day progresses, the integrator is read each hour. The data indicate an increasing rate of flow until 3 p. m. Extrapolations made during this period of 8 a. m. to 3 p. m. would indicate that if this rate is continued

throughout the 24 hours, the total delivery for the day would be considerably in excess of the pipeline contract. But the supply supervisor has seen this trend and has applied corrective measures so that by 4 p. m. the rate of flow has started to decline. The delivery rate falls until one o'clock in the morning when it begins to increase again and continues to rise until 8 a. m., the end of the pipeline day. At this time we find that the contract has been exceeded by less than 400 Mcf —well within the penalty limits.

Equipment was purchased in 1954 for 23 orifice meter runs in 15 border stations, and for the line pressure in Granite City. Installation was completed in February 1955 just as the maximum day occurred for the 1954-55 heating season. On that day one of the pipeline contracts was exceeded and a penalty of about $17,000 was incurred. Thus the story goes—so much for being tardy with the telemeter equipment. Penalties have been avoided since that February day, through the effective use of telemetering, except for one occasion when a small overrun cost about $80.

The Granite City border station is shown in *Fig. 3*. At the left is the pipeline company's building housing its metering and regulating equipment. The cabinets in the upper right contain Illinois Power telemeter equipment. The left-hand cabinet is for the flow meters and the right-hand cabinet houses totalizing and transmitting instruments.

In *Fig. 4* the border station at Hoffman may be seen. This installation is for the delivery of natural gas to Illinois Power Co.'s Mt. Vernon service area. Telemetering equipment is housed in the cabinet to the right of the pipeline company's building.

Telemeter equipment for measuring natural gas in the Hallsville station is installed in the cabinets shown in *Fig. 5*.

Ring balance flow meters are shown in *Fig. 6*, and *Fig. 7* shows an installation of slide wire receivers, totalizers, power packs and retransmitting equipment.

The border station for measuring gas delivered to Illinois Power Co.'s LaSalle area is shown in *Fig. 8*. Telemeter equipment is housed in the cabinets to the left of the meter and regulator building.

Fig. 9 illustrates the panel board in the Decatur system center. Excepting the thermometer in the lower right hand corner, the instruments with circular charts are receivers for pipeline individual metering points. The sections that look like card files contain the cyclometers for the receivers. There are two instruments with large strip charts. These provide a graphic record of the rate of flow from all telemetered points along the lines of two pipeline suppliers. The small strip chart receiver immediately above the office intercom records line pressure in Granite City. Wind velocity and direction are indicated by the instrument slightly to the left and above the intercom.

Fig. 10 is a picture of the rear of the panel board. These are the slide wire instruments for transmitting data from individual receivers to the pipeline totalizer, the large strip chart instruments on the front of the panel board.

High and low alarms were installed on the receivers in Decatur so that the operators are alerted if the load shows an unusual rise or fall. A useful side result is the immediate warning of a line break or unusual flow of gas. One day the gasman in Kewanee decided to fill his holder. Now there is nothing out of the ordinary about filling a holder, but the gas supply supervisor in Decatur noticed a decided rise in the rate of flow through the sales station that serves gas to Kewanee. It seemed as though there could have been a large leak suddenly developed, so the gasman in Kewanee was asked to check. It was then found that the holder was being filled—that nothing was wrong. So the local gas superintendents were requested to advise the telemetering section when actions such as filling holders, blowing lines or other heavy flows were planned.

On Dec. 18, 1956, the supervisor heard the Hallsville high flow alarm sound at 12:55 a. m. The heavy flow continued and the superintendent in Clinton was advised. A large leak was found in the line from Hallsville to Clinton. The line was broken and the leakage could have caused serious trouble if allowed to flow unchecked.

Accuracy checks are made continuously so as to compare telemetered results with the pipeline record of daily deliveries. Two pipeline suppliers send delivery information daily. These data are used to make accuracy reports that go to our maintenance personnel.

Tables 1, 2, 3, and *4* are typical accuracy reports for four delivery points along a pipeline. Note that the same period is covered in each report, for each border station. The reports are summarized in *Table 5* with a small percentage being added so as to include two deliveries that are not telemetered. In all cases, the telemetered quantities are compared to the pipeline billing figures and accuracy is based on the

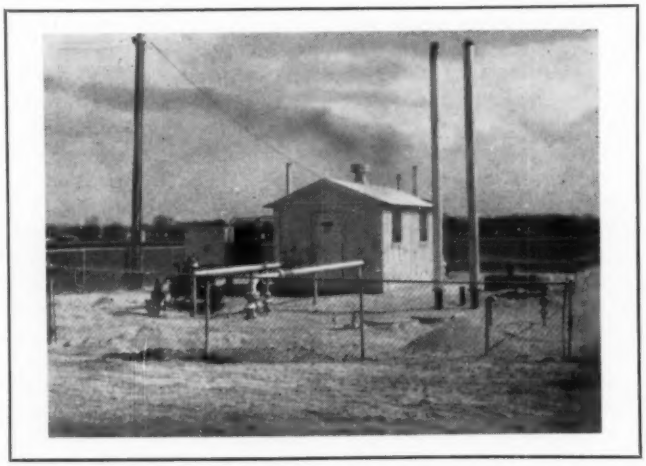


Fig. 8. Meter and regulator building at the La Salle station.

pipeline report of volume delivered.

If the accuracy of the telemeter equipment varies by more than 2 per cent from the pipeline report, an investigation is made. In a few cases the pipeline has been found to be wrong, but sometimes the telemeter equipment is in need of some minor maintenance.

Maintenance follows closely on these accuracy reports. This is in addition to periodic inspection of equipment. His verbal (not written) statement was that plus or minus 2 per cent might be obtained; and probably plus or minus four per cent of full scale might be a better figure; and that all depended upon the skill and accuracy of maintenance.

Various communication channels are used to transmit the flow data to the system center. Data leave the border station over a telephone

All other locations use telephone circuits for the entire distance to Decatur.

Our company has an underground gas storage project almost ready for the construction stage. Its control will require the installation of telemetering equipment so as to coordinate the use of storage and pipeline supply.

In the winter time, when the peak days are imminent, the best

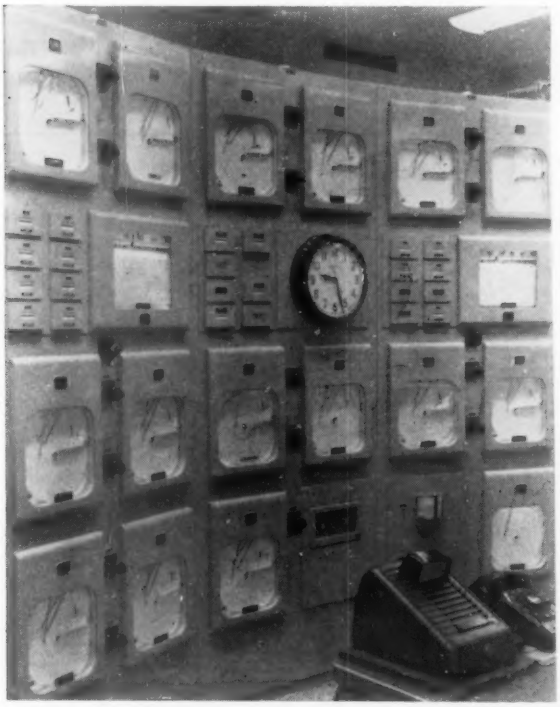


Fig. 9. Panel board at Decatur. Except for the thermometer in the lower right hand corner, the circular charts are receivers for pipeline metering points. Cyclometers for the receivers are in the sections resembling card files.

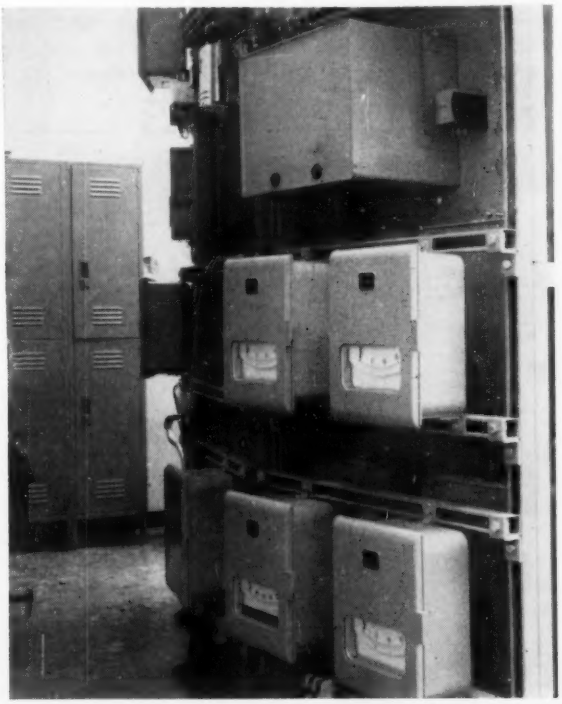


Fig. 10. At the rear of the panel board are the slide wire instruments for transmitting data from individual receivers to the pipeline totalizer.

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border station and receiving equipment. Illinois Power is fortunate in having experienced electrical technicians available for the maintenance of its gas telemeter equipment. Good maintenance is essential and our maintenance men do more than cooperate—they advise and suggest, they find where trouble could start, and eliminate the "bugs" before trouble starts.

Exceptional maintenance has been responsible for the excellent accuracy obtained. The accuracy indicated in the tables is different from that stated by the vendor of this pair. Some of these circuits terminate in a microwave station, as is the case for data accumulated along the Mississippi River pipeline. Data from Belleville, East St. Louis, Granite City and Wood River are sent to a microwave station in Wood River. Then the flow data are transmitted over the microwave system to Decatur.

Microwave is also used to transmit flow data originating in Kewanee and LaSalle to Decatur.

Galesburg flow data are transmitted over a power carrier circuit to Decatur.

weather forecasts obtainable are needed. It is only through knowledge of impending weather that the supply supervisors are able to estimate gas requirements. Barring accidents, it is the heating and other firm commitments that determine the severity and extent of curtailments, the operation of production facilities, and the use of gas in storage.

In order to have some idea of weather conditions Illinois Power has subscribed to a commercial weather forecasting service. In addition there is a weather tele-

typewriter machine installed in the gas telemetering office. The machine is connected to the United States Weather Bureau office so that information released from that office is received at once on this teletypewriter. In this way the trends in the weather are known and gas loads can be adjusted to match pipeline contracts.

If it appears that pipeline contracts will be exceeded, industrial gas contracts can be interrupted in favor of firm gas customers. If more gas is needed than is available after interruptions are made, gas manufacturing plants are started to supplement the supply. Illinois Power has 18 propane plants, three high-Btu carburetted water gas, and one oil gas plant.

In connection with the manufacture of supplemental gas, two new propane peak shaving plants have been completed recently (*Fig. 11*). These plants can make gas at 115 lb pressure, and mix this with the incoming natural gas at any predetermined percentage, thus making the output of these plants completely deliverable to the distribution systems involved. The mixture is controlled by allowing all of the natural gas to flow through an orifice plate. The differential across the orifice provides an impulse that allows more or less peak shaving gas to enter the final mixture according to whether or not the differential is higher or lower. The heating value of the peak shaving gas is adjusted according to the percentage of peak shaving gas used.

The effect of peak shaving is quickly registered on the telemeter receivers, so that the gas supply supervisors know when a plant goes on the line, and also the extent of operation. This is, the supervisors know from observing the receivers, how much peak shaving gas is being made. When peak shaving gas is required the supervisors telephone to the area in which a plant is located and advise the plant operators that gas is needed. When sufficient gas has been produced, another call is made to stop the plant operation. Correlation of natural gas deliveries and produced gas is easily made so that contracts are not exceeded.

In the gas telemetering section there is a gas supply supervisor and three assistant gas supply supervisors. The four men each work five eight-hour shifts covering 160 of the 168 hours a week. One eight-hour period from 12:01 to 8 a. m. Sunday is left vacant since the load is lightest at that time. These men do an excellent job of attending receivers, gathering essential load data, plotting daily load curves and alerting the proper persons in case of trouble or of high load conditions.

Telemetering is a far cry from the native drums in the jungles of darkest Africa or the pony express of the Old West, but all do the same type of work; that is, convey information. Before the telemeters were installed load information was obtained by personal contact over the telephone or by telegraph, sending and receiving innumerable figures, then spending time to work out the meaning of the figures. Historical information is good to have, but effective gas load control today requires modern methods of assembling information quickly and accurately. Telemetering does this job. ■

Fig. 11. Illinois Power's peak-saving propane plant at Galesburg is one of two completed recently by the company.

This article is adapted from a talk presented at the joint AGA-PCGA transmission conference held in San Francisco on May 8-10.

An improved integrating odorizer

By A. B. NEWBY and F. V. WILBY
Southern California Gas Co.
Los Angeles

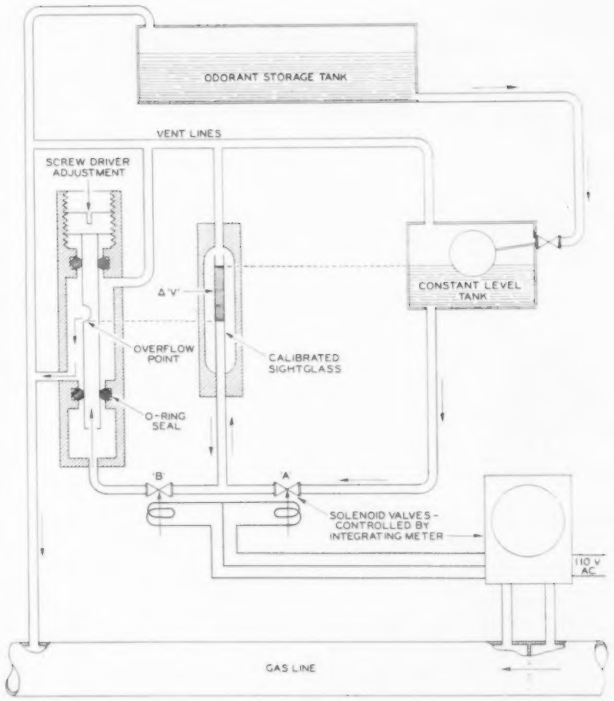

Fig. 1. Operation principle of the integrating odorizer.

THE function of an odorizer is to add odorant to a gas stream at a known and controllable rate which is proportional to the flow of the gas. The proportionality is usually achieved by utilizing the differential pressure produced across an orifice, or other constriction in the gas line, either to operate or to control the operation of the odorizer. Pitot tubes are aiso used, though infrequently, because relatively complex equipment is required to utilize the small differential pressure developed.

The several kinds of odorizers used in the gas industry have been comprehensively discussed by Senatoroff[1] and Kollock[2]. Odorizers may be classified according to whether the odorant is introduced as a vapor or a liquid, or whether or not the operation of the odorizer depends upon bypassing a portion of the gas stream through it. Disadvantages of existing odorizers are:

1. When the odorant is introduced as a vapor as in a bypass, wick, bubbler or absorption type odorizer, the rate of odorization is seriously influenced by temperature, rate of gas flow, and dilution of odorant by condensation of higher hydrocarbons from the gas stream.
2. When the operation of the odorizer depends upon bypassing a portion of the gas stream through it, the odorizer cannot be placed across an orifice used for measuring gas flow. In addition, the operation of such an odorizer is affected by contamination and corrosion by condensibles in the gas and may even be stopped by the formation of hydrates during cold weather.
3. When the rate of odorant flow is controlled by causing the liquid odorant to flow through a small orifice, fouling of the orifice will be a continuing problem, particularly at low flow rates.
4. With the possible exception of some of the more refined proportioning pump-type odorizers, all odorizers are more or less empirical in their adjustment and require periodic "calibration."

[1] Senatorff, N. K., *Odorization Practices*, AGA Proc. 684 (1950).
[2] Kollock, E. C., *Natural Gas Conditioning Equipment and Methods*, Ibid 526 (1941).

Original integrating odorizer

Briscoe and Caldon[3] set out to produce the ultimate in accurate proportioning of an odorant by employing an integrating orifice meter as the controlling element. The totalizing counter of a double integrating orifice meter was connected by a shaft so as to operate tilting mercury switches to control a system of motor-driven valves. Later, the mercury switches were replaced by a slotted disk which, as it revolved, interrupted a beam of light falling on a photocell. The output of the photocell was then amplified to control the motor-driven valves.

The passage of a given quantity of gas as measured by the integrating orifice meter caused a measured portion of odorant to be delivered into the gas stream. The size of the portion of the odorant was constant, but the frequency with which it was delivered into the gas stream was directly pro-

[3] Briscoe, C. F., Caldon, H. G. *Use of Integrating Orifice Gages in the Odorization of Gas in Pipeline Systems*, Proc. PCGA, 20, 111 (1938).

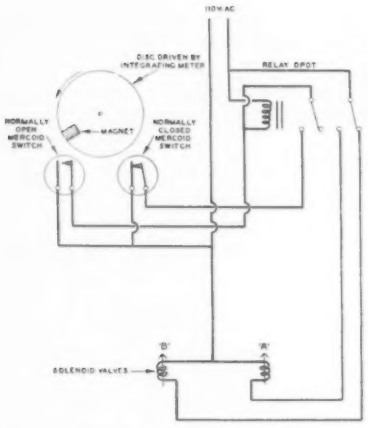

Fig. 2. Electric circuit of the odorizer.

portional to the gas flow.

This odorizer, built in 1937, was operated with only minor modifications until 1955.

Recognizing that the integrating orifice meter offers one of the most accurate, readily available means of controlling the rate of odorization, we set out to construct an odorizer that would take advantage of some of the new materials and equipment that have become available since the time when Briscoe and Caldon built their integrating odorizer.

We wished to improve on the work of Briscoe and Caldon in certain ways:

1. To make the odorizer readily adjustable to compensate for changes in rate of odorization, odorant, orifice coefficient, etc.
2. To make all components accessible and easy to adjust, remove or replace, by one man.
3. To employ commercially available components insofar as possible.
4. To reduce its cost.
5. To eliminate the motor-operated valves—they were cumbersome and require considerable floor space.
6. To eliminate leakage — with the use of concentrated odorants, no leakage, however slight, can be tolerated.
7. To permit the metering of small quantities of odorant as is necessary with the use of concentrated odorant on small gas flows.

The principle of operation of the improved integrating odorizer is shown in *Fig. 1.* Odorant flows by gravity from the storage tank to the constant level tank. The liquid level is maintained constant by means of a float valve.

The passage of a given quantity of gas causes the integrating meter to switch electric current so as to alternately energize solenoid valves A and B. As a result when one valve is open, the other is always closed. When solenoid valve A is open, odorant flows from the constant level tank into the calibrated sight glass until it reaches the level of the odorant in the constant level tank. Solenoid valve A then closes and valve B opens. Odorant then flows from the sight glass and out of the adjustable overflow tube into the gas line. The odorant level in the sight glass falls until it reaches the level of the opening of the adjustable overflow tube. The difference between these two levels is then the volume ΔV, which is the volume of the column of odorant discharged into the gas line per shot.

The electrical circuit is shown in *Fig. 2.* The integrating meter rotates a disc at a rate proportional to the rate of gas flow. A magnet mounted on the disc moves past a pair of mercury switches. The magnet first causes the normally open mercury switch to close, thus locking the DPDT relay. This opens solenoid valve A and closes solenoid valve B. Further advance of the magnet opens the normally closed mercury switch; thus releasing the relay. This causes solenoid valve A to open and B to close. Therefore, both mercury switches must be actuated by the magnet in sequence to cause one cycle of operation of solenoid valves A and B. The lock-in feature prevents vibration or chattering to cause false operation of the solenoid valves.

The volume of odorant discharged into the gas line per cycle of operation of the solenoid valves is ΔV. Its valve must be calculated so that the adjustable overflow tube may be set at the proper height. The equation for the calculation of ΔV is developed below for the double integrating Metric Integrating Orifice Meter. Similar considerations apply to any other type of integrating meter.

Let: ΔV = volume of odorant delivered per shot, ml/shot
R = rate of odorization, lb of odorant per MMcf of gas, lbs/10^6ft^3
S = specific gravity of odorant
Ps = static pressure index of integrating meter
Pd = differential pressure index of integrating meter
N = number of magnets on switching mechanism which determines the number of shots of odorant delivered per revolution
r = gear ratio of gear train operating switch mechanism
M = integrator drive motor speed, rev/min
C' = hourly orifice coefficient ft^3/hr

The quantity of odorant required per minute (ml odorant/min) to odorize a given flow of gas is:

$$\frac{\text{ml odorant}}{\text{min}} = Ps \times Pd \times C' \text{ ft}^3/\text{hr} \times \frac{1}{60 \dfrac{\text{min}}{\text{hr}}} \times \frac{1}{S} \times R \frac{\text{lb}}{10^6\text{ft}^3} \times 454 \frac{\text{ml}}{\text{lb}}$$

The quantity of odorant discharged per minute (ml odorant/min) by the odorizer to the gas stream is:

$$\frac{\text{ml odorant}}{\text{min.}} = \frac{\Delta V \text{ml}}{\text{shot}} \times N \frac{\text{shot}}{\text{rev}} \times M \frac{\text{rev}}{\text{mn}} \times \frac{Ps}{12} \times \frac{Pd}{12} \times r$$

TABLE I. SUMMARY OF INTEGRATING ODORIZER PERFORMANCE DATA

Odorizer	Gas Flow Average (MMcf/Day)	Period Operated (Months)	Desired Odorization Rate (Gal./MMcf)	Actual Odorization Rate (Gal./MMcf)	Deviation from Rate (%)
A	12	17	0.12	0.126	+ 5
B	3	4	0.09	0.0896	− 0.4
B	2	11	0.12	0.123	+ 3
B	2	8	0.13	0.126	− 3
C	5	5	0.12	0.120	0
D	0.8	7	0.12	0.107	−11
E	0.3	3	0.12	0.138	+15

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By equating the above, the following equation is obtained:

$$\Delta V = 0.00109 \frac{RC'}{SNMr}$$

The constant 0.00109, M, and r are dependent upon the construction of the integrating meter. The number of magnets, N, may be chosen so as to obtain a suitable value of ΔV; one that falls within the range of an available calibrated sight glass. S and R are determined by the type of odorant used and the rate of odorization. For convenience, these six factors may be lumped into a constant K.

Where: $K = 0.00109 \frac{R}{SNMr}$

Then: $\Delta V = KC'$

For a given odorization setup, the most frequent change made usually will be in C′, the orifice constant. To adjust the odorizer to compensate for a change in C′, the new value of ΔV must be calculated. Given the lumped constant K, V is readily calculated by the above equation.

It is well to note that all the factors involved in the determination of ΔV are readily determined with considerable accuracy. Therefore, if ΔV can be accurately controlled by the odorant metering system, the overall accuracy of this odorizer should be very high. As will be shown later, this is the case.

The double integrating Metric Integrating Orifice Meter was chosen as the controlling element. The electric switching device commercially available for actuating a remote counter for this integrating meter was used to actuate the solenoid valves. This meter requires a source of 110-v AC. The interior of this instrument is shown in *Fig 3*.

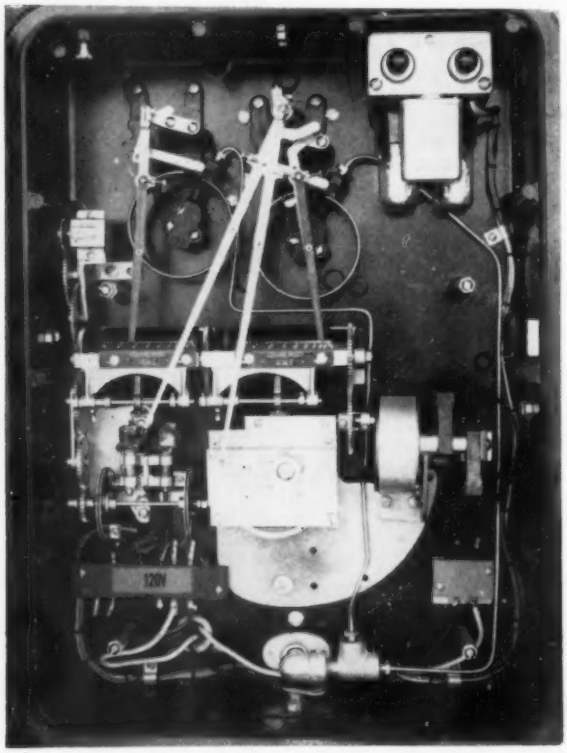
The unit in the upper right hand corner of the meter case includes the relay which operates the solenoid valves, lights to indicate which solenoid valve is energized, and two time delay relays. The latter allow the solenoid valves to be energized for only 10 seconds, thus preventing them from heating up and producing bubbles in the odorant metering system. The odorant is at line pressure and considerable gas dissolves in it. If heated, some of the dissolved gas would be released as bubbles.

All electrical components used are either explosion-proof or hermetically sealed. The orifice meter may be located remote from the odorizer. The orifice meter modified as shown may be used simultaneously for several functions such as:

a. Meter gas flow
b. Remote indication of gas flow
c. Operate odorizer
d. Operate gas sampler on similar device.

Consideration was given to the choice of materials in the odorizer. Most odorants are powerful organic solvents. Therefore, gaskets and O-rings had to be made of materials such as polyethylene, teflon, and Kel-F. The adjustable overflow tube and solenoid valves were made of stainless steel to minimize malfunctioning from corrosion.

The design of the adjustable overflow tube-calibrated sight glass unit is one of the unique features of this odorizer. The assembly is shown in *Fig. 4*. The adjustable overflow tube employs O-ring seals to permit adjustment of the overflow height without leakage of odorant at pressures in excess of 800 psig. The adjustment of ΔV is made with a screwdriver while the



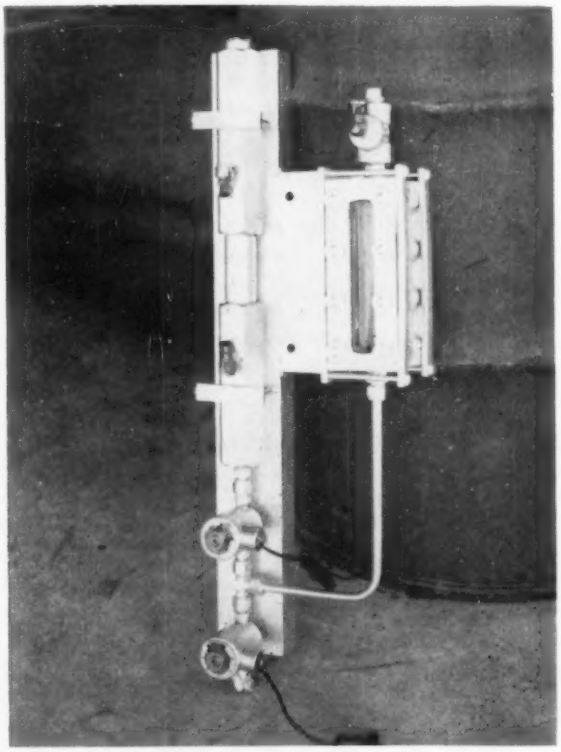


Fig. 3 (left). Integrating orifice meter. Fig. 4 (right). Adjustable overflow tube, sight glass, solenoid valve unit.

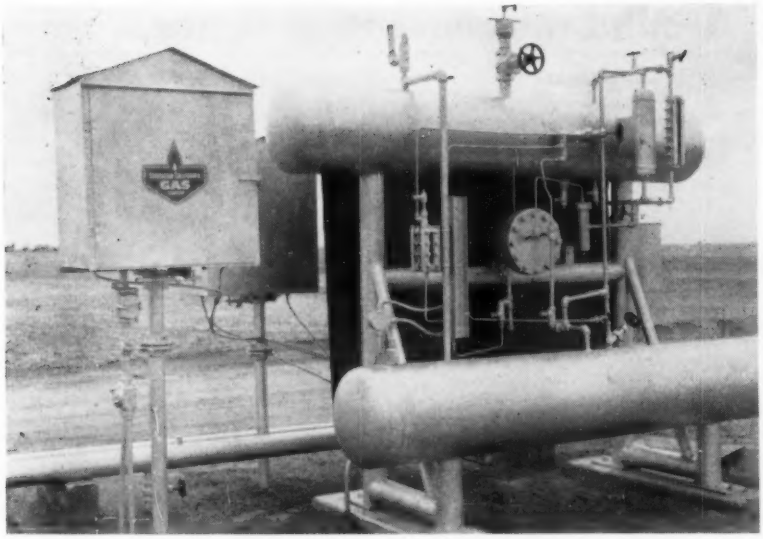


Fig. 5. Installation of integrating odorizer.

odorizer is in operation and under pressure. To facilitate the adjustment of ΔV, a simple modification of the integrating meter permits the fill and dump cycle to be repeated continuously at intervals of less than a minute. This eliminates having to wait for several minutes per cycle when the gas flow is low. The calibrated sight glass is made from standard precision calibrated laboratory glassware tubes housed in a standard high pressure sight glass. Various sizes of calibrated tubes are available, making it possible to inject as little as 0.1 milliliter per shot.

The practical range of gas flow to which this odorizer can be applied is exceptionally wide. The minimum gas flow that can be odorized with concentrated odorant is about 10 mcf/hr. There is no practical upper limit.

The complete odorizer is shown in *Fig. 5*. The storage tank was made to hold a full 55-gal. drum of odorant. A calibration tank permits spot checks of operation. The constant level tank is fitted with an overflow. Should the float valve leak causing the liquid level to rise, the odorant will overflow into a sump tank of the same capacity as the storage tank. Thus over-odorization is avoided. The odorant in the sump is raised back into the storage tank by gas pressure. During tests or break-in the odorizer may be operated so as to dump into the sump tank instead of the line. The odorizer is relatively portable and may be picked up as a unit for transporting.

The requirements for the installation of an integrating odorizer are as follows:

a. A source of electric power.
b. An orifice in the gas line. A pinched valve may be used instead of an orifice, providing its setting can be calibrated. It is possible to use an orifice that is as far as several miles from the odorizer.
c. A ½-in. tap in the line a few feet downstream from the orifice, for the injection of odorant into the gas stream. Liquid odorant has a deleterious effect on the rubber gaskets used in many orifice fittings.
d. A solid level location on which to place the odorizer. A concrete pad is desirable but not necessary.
e. The specific gravity of the odorant, rate of odorization and the orifice coefficient for the specific location. From this information, the size of the calibrated sight glass and the number of magnets may be chosen.

In January 1955, the first unit of this type of integrating odorizer was placed in service. To date nine of these odorizers have been placed in service odorizing lines which have maximum gas flows ranging from 0.4 to 27 MMcf/day. Two units have been in operation for well over two years.

In *Table 1* are data on the operation of five integrating odorizers that have been in use long enough to furnish significant information.

Note the extremely low rate of odorant flow that can be achieved with a high degree of accuracy. Most of these odorizers are in remote locations and are inspected weekly. These odorizers have proven to be extremely reliable and are not affected by temperature changes or by water or other contaminants in the gas.

Summary

1. The rate of odorization depends only upon known and controllable factors.
2. Adjustment of the rate of odorization is positive and does not require cut-and-try methods. One man with a screwdriver can adjust the rate of odorization in 10 minutes.
3. Adjustment once made will not gradually change due to fouling of an orifice or condensation of contaminants from the gas.
4. All components may be inspected, removed and replaced by one man with simple tools.
5. Operation is not affected by temperature nor by the presence of water or other contaminants in the gas.
6. First cost is competitive with other odorizers of comparable accuracy.
7. The full cost of the integrating meter and switching mechanism need not apply to the odorizing function since the same unit can serve other functions such as a meter for the gas flow, a remote indicating meter, and to operate a gas sampler. ■

ACKNOWLEDGMENTS

Several people made very significant contributions to the development of the integrating odorizer. E. J. Horton assisted all through the design, development and construction. M. Tanner, E. Ray and J. Stidham made the field installations, "worked out the bugs," and gathered the operating data. S. K. Gally gave continual encouragement and support to this project.

This article is adapted from a talk presented at the joint AGA-PGGA transmission conference held in San Francisco, May 8-10.

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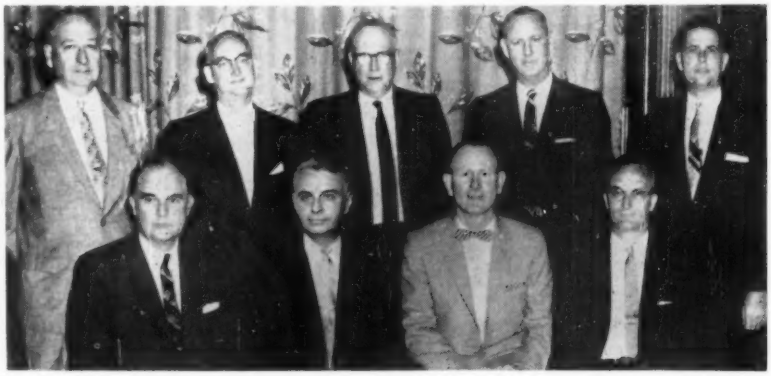
Around the convention circuit

In Miami Beach for the AGA production conference were (front row, from left): W. T. Swann, Brooklyn Union Gas; R. W. Gilkinson, Rochester Gas Co., A. W. Olsen, Providence Gas Co. Back row, from left: G. L. Calderwood, Rochester Gas; E. D. Crouch, Long Island Lighting Co.; P. E. Reichardt, Washington Gas Light Co.; and E. O. Rossbach, Brooklyn Union.

Looking over the program for the joint PCGA-AGA transmission conference held in San Francisco recently are (front, from left) H. W. Egger, chairman of the AGA subcommittee on compressor stations, United Gas Pipe Line; Lowell L. Elder, Columbia Gas System, and chairman of the pipeline subcommittee. Back row (from left: R. C. Bain, Arkansas Louisiana Gas Co.; Dwight B. Sprow, National Gas Pipeline Co. of America; and H. F. Steen, El Paso Natural Gas Co. and chairman of the AGA transmission committee.

Southern Gas Association elected these new officers and directors at the recent convention. Seated (from left) are Curtis M. Smith, Tennessee Gas, president; Carl E. Cloud, MidSouth Gas, 1st vice president; Oliver W. Clark, Southern Natural, 2nd vice president; R. L. Hinch, Nashville Gas, secretary. Standing: W. R. McLaughlin, Rockwell Manufacturing, director; George D. Guler, Minneapolis-Honeywell, director; H. C. Webb, Oklahoma Natural, vice chairman advisory council; Jas. A. Davis, Empire Southern Gas, chairman advisory council; and H. J. Friloux, Norco Gas & Fuel, director.



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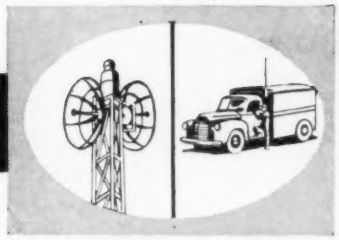

By FRANK CHAPMAN

FCC must decide who has the most pressing need

MEMBERS of the Federal Communications Commission are convinced they will have to decide the microwave controversy only on the basis of which of the industries demanding space have the most pressing need.

"We're going to have to scoop the cream off in deciding this question," is the way one commissioner puts it.

Thus the commissioners early in hearings had decided that such factors as investments in equipment or the length of time an industry has used the ultra-high frequency microwave bands (890 mc and above) won't help the gas industry much in its fight to maintain space.

Generally, that seems to be all right with the gas industry, at least as far as the pipelines and some distributors are concerned. Testimony at the hearings shows that spokesmen are ready to build their case on the basis of need.

Questions and comments made during the grueling course of the hearings—they opened May 20 and will run at least through July—indicate also that the telephone companies, fighting to take over most of the microwave frequencies, have planted the idea among some commissioners that microwave is being used to cut telephone expenses by private users.

Denials, however, came as fast as this allegation was made to gas industry spokesmen. Loring E. Heckman, a vice president of the Columbia Gas System Service Corp., said in the case of his far-flung firm, installation of microwave had if anything increased the use of common carriers services and thus increased telephone tolls as the system expanded.

This charge stems from the fact that most microwave systems must begin or end, or both, at a telephone switchboard. Most firms, however, say they have strict rules that a voice microwave circuit cannot be plugged into the common carrier lines at the switchboard in order to save phone costs.

The Operational Fixed Microwave Council, a group of varied organizations representing microwave users, filed a tally of microwave stations as the hearings opened. According to the group, there are now at least 3000 microwave beams in operation or proposed, mostly in the 2000- and 6000-mc bands.

Among the dozen witnesses for the National Committee for Utilities Radio at the hearings were Mr. Heckman, who presented the Committee's pipeline position, and Earle D. Glatzel who represented a group of 11 utilities and an association.

Mr. Glatzel testified that his group believes "that freedom of choice with respect to ownership, operation and maintenance of communications facilities must be maintained in order that electric, gas and water utilities may adequately and properly discharge their duties and responsibilities to the public." He pointed out that the group for the past 12 years had developed and expanded microwave systems and invested millions of dollars in equipment.

If the FCC finds it must deny private microwave usage to some classes of users, then the decision as to who gets space should be based on the "ultimate benefits to the public," Mr. Glatzel said.

Sharing of private point-to-point systems should be limited to voluntary arrangements, he added.

Mr. Glatzel, as did most industry witnesses, insisted that the availability of common carrier microwave circuits should not be considered as a condition of eligibility for licensing private systems.

Common carrier facilities in many cases would not meet the highly specialized requirements of many utilities, and thus the utilities must have complete and absolute control of their operational equipment, he said. He also opposed any limitations on frequencies below 10,000 mc in terminal or metropolitan areas as unnecessary, and similarly on frequencies above 30,000 mc.

He also opposed sharing of frequencies by common carriers and private users.

Columbia Gas System now operates 2500 circuit miles of carrier equipment, Mr. Heckman told the commission, to provide adequate communication over the system's widespread operations as well as to control valves, regulators and compressor stations. Companies such as Columbia need their own microwave facilities because they can be kept "intact when common carriers are out of service because of labor troubles, ice storms, or floods," he added.

Microwave systems also reach points not accessible by common carriers, he testified. Whenever possible, however, his firm and most others lease or otherwise use common carrier facilities, he said. ■

ANTICIPATED ADDITIONAL GAS HOUSEHEATING CUSTOMERS IN THE UNITED STATES BY STATE, 1957-1960

(Thousands of Customers)

	1957–1958 Heating Season			1958–1959 Heating Season			1959–1960 Heating Season		
	Total	New Dwelling Units	Existing Dwelling Units	Total	New Dwelling Units	Existing Dwelling Units	Total	New Dwelling Units	Existing Dwelling Units
United States	1,248	754	494	1,271	742	529	1,187	737	450
New England	50	10	40	53	12	41	55	13	42
Connecticut	14	4	10	14	5	9	15	6	9
Maine	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Massachusetts	27	5	22	28	6	22	27	6	21
New Hampshire	2	(a)	2	2	(a)	2	2	(a)	2
Rhode Island	7	1	6	9	1	8	11	1	10
Vermont	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Middle Atlantic	188	88	100	180	87	93	174	84	90
New Jersey	38	28	10	39	29	10	38	28	10
New York	91	28	63	84	26	58	82	25	57
Pennsylvania	59	32	27	57	32	25	54	31	23
East North Central	291	127	164	346	128	218	293	128	165
Illinois	36	14	22	128	19	109	103	21	82
Indiana	16	6	10	32	12	20	30	12	18
Michigan	103	36	67	63	29	34	45	28	17
Ohio	96	58	38	84	55	29	80	54	26
Wisconsin	40	13	27	39	13	26	35	13	22
West North Central	134	55	79	126	49	77	103	48	55
Iowa	18	5	13	32	6	26	23	5	18
Kansas	12	12	(a)	10	10	(a)	10	10	(a)
Minnesota	22	9	13	23	9	14	19	9	10
Missouri	61	20	41	43	18	25	37	18	19
Nebraska	11	7	4	8	4	4	7	4	3
North Dakota	4	1	3	5	1	4	2	1	1
South Dakota	6	1	5	5	1	4	5	1	4
South Atlantic	99	71	28	94	68	26	96	66	30
Delaware	2	1	1	2	1	1	2	1	1
District of Columbia	3	1	2	3	1	2	3	1	2
Florida	10	7	3	9	6	3	8	6	2
Georgia	24	22	2	23	21	2	23	20	3
Maryland	23	18	5	23	18	5	23	17	6
North Carolina	7	3	4	8	4	4	11	5	6
South Carolina	7	2	5	5	1	4	6	1	5
Virginia	15	13	2	14	12	2	13	11	2
West Virginia	8	4	4	7	4	3	7	4	3
East South Central	59	36	23	58	36	22	58	37	21
Alabama	23	9	14	22	9	13	22	10	12
Kentucky	17	12	5	16	11	5	16	11	5
Mississippi	10	9	1	11	10	1	11	10	1
Tennessee	9	6	3	9	6	3	9	6	3
West South Central	140	129	11	135	125	10	135	127	8
Arkansas	13	7	6	11	7	4	9	6	3
Louisiana	27	25	2	26	23	3	25	23	2
Oklahoma	14	14	(a)	13	13	(a)	15	15	(a)
Texas	86	83	3	85	82	3	86	83	3
Mointain	65	46	19	59	45	14	57	45	12
Arizona	17	15	2	18	16	2	19	17	2
Colorado	18	16	2	18	16	2	18	16	2
Idaho	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Montana	12	1	11	7	1	6	5	1	4
Nevada	2	2	(a)	1	1	(a)	(a)	(a)	(a)
New Mexico	7	7	(a)	6	6	(a)	6	6	(a)
Utah	7	3	4	7	3	4	6	3	3
Wyoming	2	2	(a)	2	2	(a)	3	2	1
Pacific	222	192	30	220	192	28	216	189	27
California	189	182	7	189	183	6	185	180	5
Oregon	13	2	11	13	2	11	13	2	11
Washington	20	8	12	18	7	11	18	7	11

(a) Less than 500 customers.

HEATING CUSTOMERS . . .

WITH the 1.3 million customers added during the 1956-57 heating season, the gas industry has increased its total of gas househeating customers to 16.7 million. This represents an 8.5 per cent gain over the previous year, according to a report from the AGA, which also predicts the figure will rise to nearly 20.5 million by the end of 1959.

Gas househeating customers, the AGA says, represent 60 per cent of all residential gas consumers and 71 per cent of all residential users who are considered to be part of the potential gas househeating market. One year ago, with 15.4 million customers, the comparable figures were 57.5 and 69.2 per cent.

Existing dwelling units, through conversion from other types of fuel, will account for almost 40 per cent of an additional 3.7 million new gas customers to be served during the next three heating seasons.

The AGA pointed out that its figures do not include families heating their homes with L. P. gas nor do they reflect the number of dwelling units served by central gas heating in multiple dwellings.

The most significant anticipated gains during the next three seasons are predicted for the East North Central area, where approximately 930,000 new units will be added. The Pacific region ranks second with an increase of approximately 658,000. Third is the Middle Atlantic states, in which 542,000 units will be installed, and fourth is the West South Central region, which anticipates adding 410,000 new gas heating units.

up 8.5 per cent in 1956 to total 16.7 million

The most significant expected gain in any one state during this period will occur in California, where approximately 563,000 additional dwellings will use gas heat. Percentagewise, this amounts to approximately 86 per cent of the new installations to be made in the Pacific region and about 15 per cent of all new installations to be made by the industry throughout the nation.

New home construction will account for 60 per cent of new gas househeating customers. In specific areas, however, anticipated conversion of existing dwelling units continue to exceed new homes as a source of additional gas househeating customers. In the New England area 78 per cent of the anticipated gain will come from conversion of existing dwelling units. Conversions as a percentage of total new heating customers in the East North Central, West North Central and the Middle Atlantic regions will be 59, 58, and 52 per cent, respectively.

As of Nov. 30, 1956, there were 58 utilities serving 5.3 million residential customers (equivalent to about 19 per cent of all households served by the industry) which still had in effect some restrictions on new heating installations. Last year there were 61 utilities, serving 6.7 million families who were in a similar position. Increasing supplies of gas and greater utilization of underground storage facilities have been responsible for this improvement. Frequency of restrictions probably will be further reduced in the near future. ■

EXISTING AND POTENTIAL GAS HOUSEHEATING CUSTOMERS IN THE UNITED STATES, BY STATE NOV. 30, 1956, ESTIMATED GAS HEATING INSTALLATIONS DURING DECEMBER 1956 AND ESTIMATED GAS HOUSEHEATING CUSTOMERS AS OF DEC. 31, 1956

(Thousands of Customers)

	Existing Residential Customers November 30, 1956		Estimated Number of Gas Installations During December 1956	Estimated Gas Househeating Customers as of Dec. 31, 1956	Potential Residential Househeating Customers[a]
	Total	Househeating			
United States	27,733	16,571	159	16,730	23,704
New England	1,533	223	6	229	1,140
Connecticut	353	37	1	38	339
Maine	36	2	(b)	2	25
Massachusetts	938	147	3	150	607
New Hampshire	36	9	1	10	23
Rhode Island	150	28	1	29	132
Vermont	20	(b)	0	(b)	14
Middle Atlantic	6,931	1,927	21	1,948	5,074
New Jersey	1,279	226	3	229	1,083
New York	3,679	732	11	743	2,170
Pennsylvania	1,973	969	7	976	1,821
East North Central	6,207	3,154	48	3,202	5,130
Illinois	1,943	680	9	689	1,418
Indiana	657	208	3	211	471
Michigan	1,294	662	12	674	1,112
Ohio	1,851	1,463	19	1,482	1,783
Wisconsin	462	141	5	146	346
West North Central	2,173	1,599	17	1,616	1,919
Iowa	350	242	3	245	294
Kansas	441	421	5	426	428
Minnesota	394	266	2	268	349
Missouri	679	429	6	435	587
Nebraska	230	187	1	188	185
North Dakota	33	18	(b)	18	31
South Dakota	46	36	(b)	36	45
South Atlantic	1,998	1,170	11	1,181	1,651
Delaware	55	10	(b)	10	48
District of Columbia	165	66	1	67	128
Florida	186	107	1	108	57
Georgia	396	332	2	334	364
Maryland	473	197	3	200	394
North Carolina	70	28	(b)	28	63
South Carolina	47	15	(b)	15	26
Virginia	298	136	2	138	263
West Virginia	308	279	2	281	308
East South Central	1,126	930	8	938	1,051
Alabama	347	271	3	274	329
Kentucky	338	260	3	263	306
Mississippi	212	210	1	211	212
Tennessee	229	189	1	190	204
West South Central	3,079	3,073	23	3,096	3,079
Arkansas	221	221	2	223	221
Louisiana	545	539	3	542	545
Oklahoma	500	500	3	503	500
Texas	1,813	1,813	15	1,828	1,813
Mountain	893	843	6	849	880
Arizona	212	209	2	211	210
Colorado	265	253	(b)	253	259
Idaho	1	(b)	(b)	(b)	(b)
Montana	93	88	(b)	88	92
Nevada	18	16	(b)	16	18
New Mexico	131	131	1	132	131
Utah	120	100	3	103	118
Wyoming	53	46	(b)	46	52
Pacific	3,793	3,652	19	3,671	3,780
California	3,653	3,601	15	3,616	3,653
Oregon	84	34	2	36	81
Washington	56	17	2	19	46

(a) Including customers already using gas for househeating.
(b) Less than 500 customers.

By J. FRED EBDON

Saskatchewan Power stepping up system development

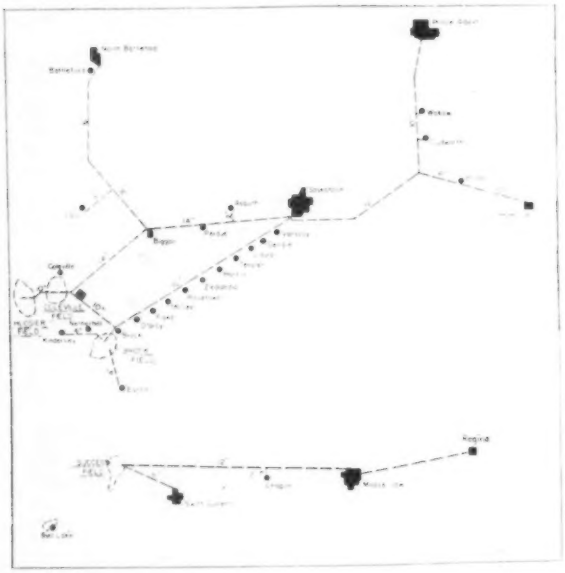

Fig. 1. Saskatchewan Power's system.

GAS industry operations in the province of Saskatchewan are paced by Saskatchewan Power Corp. This combination utility company serves about 30 communities in the province with natural gas. Some of these are barely worthy of the name. Others are growing towns and cities.

Saskatchewan Power Corp. is a Crown Corporation that evolved from the Saskatchewan Power Commission in 1949. The gas operations have been expanded in recent years and a comprehensive expansion-construction program is now underway.

The gas transmission and distribution system operated by Saskatchewan Power was started in 1952. The map on *Fig. 1* shows the development of the system at the end of 1956. The acceleration of the gas system's development is illustrated by the statistics shown in *Table 1*, which details the growth in customers in 1956.

Completely new gas distribution systems were constructed in these communities during 1956:

Asquith	Humboldt
Battleford	Moose Jaw
Bigger	North Battleford
Bruno	Perdue
Cudworth	Swift Current
Eston	Wakaw
Gull Lake	

In addition, the 1956 construction program included installation of about 235 miles of pipeline for transmission service. A 12-in. pipeline extending 117 miles from the Success Gas field over to Moose Jaw formed a major part of this program (see *Fig. 1*). The 6-in. line from this field to Swift Current was part of the 1955 construction program.

Paradoxically, Regina—the capitol of Saskatchewan, the largest city in the Province and the headquarters of Saskatchewan Power Corp.—does not have gas service at time of writing. However, this city is currently the scene of construction activity that will result in the installation of a completely new gas distribution system. It is one of the rare instances of a new distribution system being designed and constructed from the ground up.

Regina is the heart of the great wheat-, and other grain-growing belt in the province of Saskatchewan. The surrounding country quickly shows its location as a center province of the Great Plains region. It is flat. Also, it impresses one as being semi-arid, but, pot holes and small lakes have a way of popping up.

Early in their expansion program, Saskatchewan Power Corp. retained Fish Service Corp., Houston, to survey, design, and supervise construction of its system's development. This relationship has continued. Fish Services maintains a staff in Regina that is constantly on call from Saskatchewan Power.

The new distribution system at Regina will take gas through a master town border station located on the southwestern corner of the city. This station will be fed from a tap on Trans-Canada's 34-in. pipeline about 400 yd due south. From the TBS, an 18-in. main feeds into a 16-in. loop that skirts the periphery of the town. This loop reduces to 12 in. on the northern section.

One of the modern features of the Regina system design is the provision for a 10-in. industrial loop within the section of the city where surveys by Fish Services indicate expansion can be expected. Another design features the installation of a Dresser coupling on one end of each sectionalized valve. This practice provides for expansion and contraction due to variance in soil temperature and moisture content. Both reach relatively extreme values in this climate.

The Regina feeder loop is designed for 100 psig operating pressure; however, it will be operated at about 65 psig during the foreseeable future. Seven or eight district regulator stations (see *Fig. 2*) will reduce pressure from 10 to 15 psig for operation of the distribution system segments. Gas pressure will be reduced to utilization value at service regulators mounted at the customers' meter installations.

All piping in the distribution system will be welded steel pipe from 16 in. on down. It will be coated and wrapped with asphalt-based pipeline enamel. About 150 miles of main in various sizes will be installed in Regina. Another 150 miles of service line piping will be needed to complete the system.

Pipe is installed with a minimum of 36-in. cover. Service lines to commercial establishments and public buildings are fitted with curb-cocks. Service lines for residences run underground to the house wall, then enter the building aboveground. The service regulator is installed on the riser outside of the house. A meter stopcock is similarly installed outside. The customers' meters are installed inside, usually in basements.

Regina has a population that is currently estimated between 90,000 and 100,000. These people should occupy about 30,000 households by 1960. The city is following the Canadian trend of increasing the number of dwellings and family units at a greater rate than the population is growing.

Saskatchewan Power Corp. is installing service lines at a fast clip. They plan to install 10,000 services (all new, of course) before the end of the 1957 construction season. However, some of these will not be put in active service for the 1957-58 heating season. Probably 7500 services will be active this winter.

In its five-year forecasts, Saskatchewan Power expects to develop about 80 per cent saturation for gas service. The big domestic loads will be for space heating and water heating. Gas cooking and clothes drying saturation will be smaller.

TABLE 1. OPERATION AND MAINTENANCE STATISTICS

Location by district	Customers connected Dec. 31, 1955	Dec. 31, 1956
Northern system		
Saskatoon*	10,263	12,540
Humboldt-Bruno	**	292
Biggar-Perdue	**	320
Rosetown*	793	900
Kindersley-Eston*	841	1,122
Prince-Albert	1,167	2,189
Wakaw-Cudworth	**	185
N. Battleford-Battleford	**	679
	13,064	18,227
Southern system		
Swift Current	**	950
Moose Jaw	**	1,139
Gull Lake	**	142
Total	nil	2,231
Grand total	13,064	20,458

*Saskatoon includes Vanscoy, Delisle and Laura. Kindersley-Eston includes Brock, Coleville and Netherhill. Rosetown includes D'Arcy, Fiske, McGee, Zealandia, Harris and Tessier. Biggar-Perdue includes Asquith and Palo.
**No distribution system in 1955.

The space heating load looks particularly attractive. The climate of the Regina area produces a rather long, unkind winter by U. S. standards. Degree-day deficiencies over a 30-year period average 10,770 per year. Regina can expect 1940 DDD during the month of January alone. Outside temperatures in the range of —28 to —30° F are not unusual. Also, the winds tend to blow across the wide plains around the city.

The market for gas-fired appliances in Regina is promising. Electric ranges currently dominate the kitchens because natural gas service has not been available in the city. It is not contemplated that many of these appliances will be replaced in existing dwellings during the first two years. However, when the advantages of versatile automatic gas ranges become recognized through attrition and through installation in new homes, the picture will start to change. About 5000 gas ranges will be installed by the end of the fifth year of natural gas system operation.

Gas refrigeration and air conditioning appliance development will be unspectacular in the Regina area. Clothes dryers will start a transition to gas and it is estimated that 2500 gas-fired units will be in the homes during the fifth year.

Water heating in Regina homes is done almost entirely by electricity at the present time. A shift to gas-fired water heaters is expected. The trend to automatic clothes washers and dish washers is just getting started good in comparison to those units in the homes of the United States. Gas water heaters will be needed to produce the high recovery rate required for these handy home appliances and for cushion hot water for other household uses. Probably 20,000 automatic, storage, gas-fired water heaters will be furnishing a load for the gas distribution system in Regina at the end of the fifth year of operation.

Space heating will be a main foundation in load building that is expected to develop a 90 MMcf peak day for Regina. The trend is toward central heating units and is expected there will be 22,000 gas-fired units in operation during the fifth year. Some of these will be furnaces converted from oil; others will be new installations.

The initial natural gas for the Regina distribution system will be from the Trans-Canada pipeline. At the moment this is written, however, no contract between Trans-Canada and Saskatchewan Power exists. By the time you read it, such a contract will be a reality. In any case, Trans-Canada is constructing a tap and measurement facilities to make the delivery and Saskatchewan Power is building its town border station a few hundred yards therefrom.

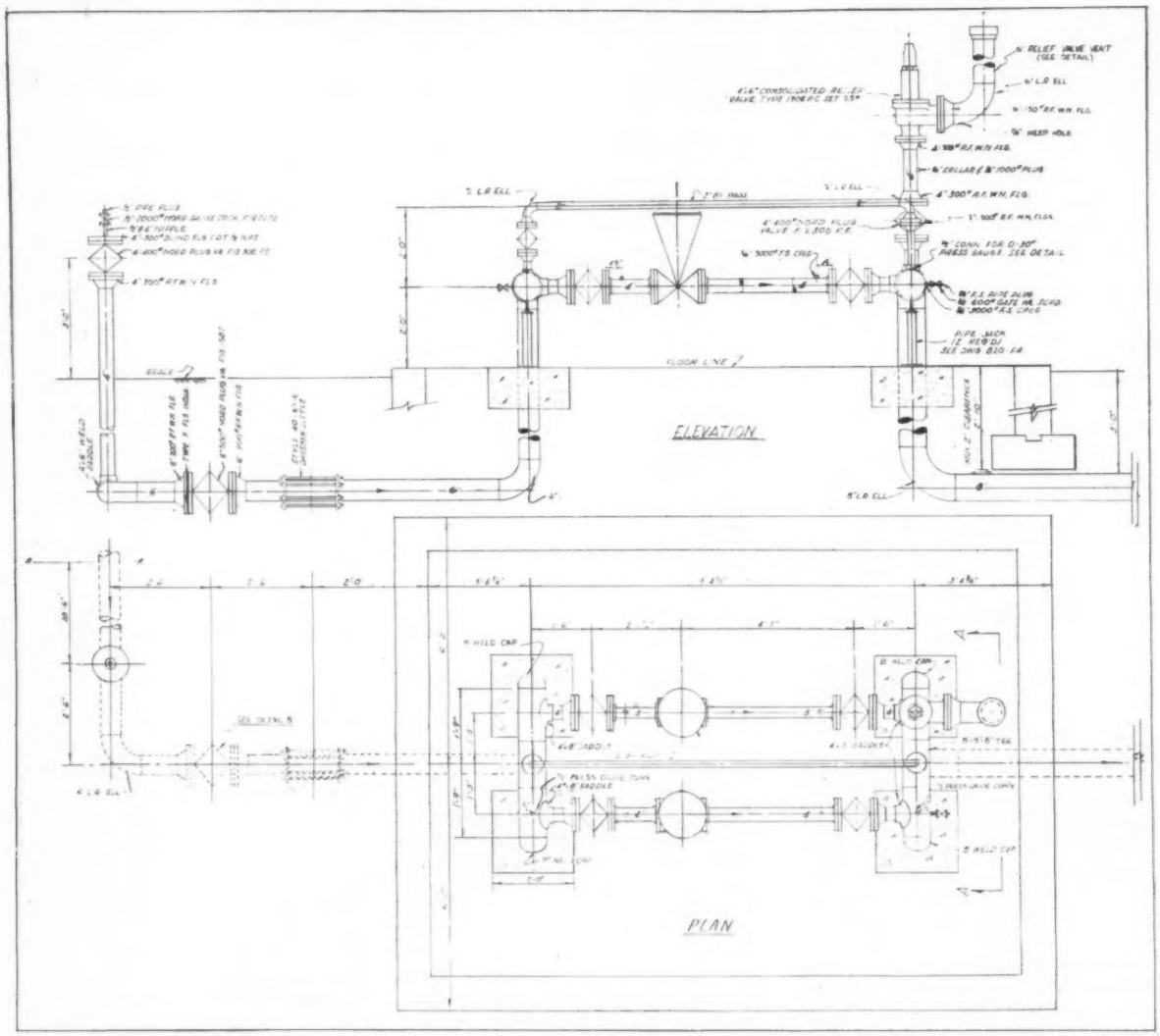

Fig. 2. District regulator stations will reduce pressure from 10 to 15 psig for operation of the distribution system segments.

Contract talks between TransCanada and Saskatchewan are continuing. Involved are a moderate continuous supply of gas for Saskatchewan Power for a period of 20 years and the entire gas requirements for the cities of Moose Jaw and Regina for the 1957-58 season.

Negotiations are also underway for bringing natural gas from the Hatton and Many Islands gas fields in western Saskatchewan and eastern Alberta. Contracts have been signed but must wait the approval of the Alberta Conservation Board. There is the possibility of bringing natural gas into the Saskatchewan Power system from some new fields in the southeastern part of Saskatchewan. These may well be extensions of the Williston Basin.

Major fields supplying the northern section of Saskatchewan Power's system are the Hoosier, Coleville, and Brock fields. Under the influence of the system's expansion, a compressor station will be required. This station is currently under construction at the apex of the branch made by the 10-in. and 14-in. pipelines coming out of the Coleville and Hoosier gas fields (see *Fig 1*). It will put through 60 MMcf/day with three 1100-hp Cooper-Bessemer reciprocating engine compressor units. About $1 million will be required for the project. Fish Services designed and is supervising construction of the station.

Withdrawals from the northern fields in 1956 were:

Brock Field	1,187,982 Mcf
Coleville Field	4,540,494 Mcf
Hoosier Field	290,018 Mcf

This was the first year of operation from the Hoosier Field. Gas reserves continue adequate from the other two fields.

In the southern section of the system, the Success gas field has been pretty well depleted. As it approaches the ultimate limit of economical production on a planned basis, research is being done to determine the feasibility of converting it into a storage reservoir. This plan appears most promising. Gas reserves for the southern section will have to come from the well established fields in the Medicine Hat area or from Trans-Canada. Probably both will be utilized. Also, there have been some encouraging natural gas plays in the southeastern corner of Saskatchewan that may provide additional gas reserves. ■

WASHINGTON

Gas bill not dead—yet, but it may expire soon

By NEIL REGEIMBAL
GAS Washington Bureau

THE HARRIS - O'HARA Gas Bill is not dead—yet. But it is hanging in a state of suspended animation, and may expire at almost any time.

The compromise measure, known to be in poor legislative health when it was introduced because it attempted to straddle a barbed fence, has suffered a long series of critical injuries. Most of the damage has been done by what were believed to be friends of the bill.

First sock the bill had to weather came from spokesmen for the President in the form of two proposed amendments. One would permit the Federal Power Commission to consider costs and the other would require a review of existing contracts containing definite escalation clauses.

The review amendment alone could kill the bill if the White House insists on it. There is a feeling that this was thrown in to be traded out in order to get the cost amendment.

Backers of the bill spent as much time during the four weeks of hearings before the House Commerce Committee fighting against the Administration amendments as they did talking up the merits of the measure. Thus once again they found themselves on the defensive.

Mid-way in the course of the hearings, the Texas Independent Producers & Royalty Owners Association, which had at least generally supported the Harris-O'Hara bill as the only possible compromise, decided it didn't go far enough.

TIPRO officials proposed further amendments to permit so-called two-party favored nations escalation clauses, shift the burden of proof in FPC rate hearings from the producer to the objector; allow cancellation of contracts if the government extends controls to a producer, and extend the antidiscrimination provisions of the Natural Gas Act to producers.

The proposed amendments permitting favored-nations clauses and permitting cancellation could remove much of the present support from distributors and probably would cause Administration to veto it if Congress passed them.

As a result of the wrangling, many borderline congressmen have become disenchanted with gas legislation once again.

Although it appeared from the start that the bill would probably take two years to get to a vote in the Senate—if the House didn't kill it—the flat refusal of Senate leadership to even consider it this year means the bill will not have clear sailing next year either.

Senate leaders summed up the growing doubts about the bill's sex appeal by saying there was no point in holding lengthy hearings and extended Senate debate on a bill "whose fate in the House is uncertain."

"Administration amendments to the bill are unsatisfactory to the industry; the house vote will probably be close, and the lack of active support from the President is hurting the bill's chances, so why get the fuss started now," is the way a Senate leader summed it up.

Sen. Warren G. Magnuson, (D.,—Wash.), chairman of the Senate Commerce Committee, says his group won't take up the bill until next January, at the earliest.

Washington political pundits differ in what effect the delay until 1958 will have. Some claim that the bill's chances in an election year are bad, because of adverse reaction it creates among consumers (also known as voters). Others say the delay will give backers time to round up some badly needed support in the Commerce Committee.

The hearings produced little startling aside from the Administration's unexpected and perhaps fatal amendments. Mayors and governors took turns blasting the bill. They said it would result in increased price to the "captive" consumers by lifting utility-type control over producers. Some grudgingly admitted they might not oppose the bill if consideration of costs were made mandatory, instead of permissive as proposed by the President.

Opponents of the bill also claimed that gas producing is a "monopolistic" industry, with 61 producers controlling 80 per cent of the production.

Forces fighting the bill in many cases threw their support behind the so-called "compromise" bill introduced by Rep. T. H. Macdonald, (D.,-Mass.), which would exempt

(*Continued on page* 74)

all producers which sell less than 2 billion cu ft a year in interstate commerce and also behind a bill sponsored by Rep. Harley O. Staggers, (D.,-W. Va.), which would incorporate that feature with provisions giving the FPC jurisdiction over direct sales and prohibiting sales of gas below cost.

The Administration also has proposed that the Harris-O'Hara bill be amended to prohibit sales for direct consumption below actual cost plus a fair proportion of fixed charges, and grant the power of eminent domain for development of underground storage reservoirs. But these proposals were not made with the same force that was put behind the cost and review amendments.

Outstanding difference between this year's hearings and hearings in 1955 and 1956 on the ill-fated Harris-Fulbright bill was the position of the gas distributors. They bitterly opposed the earlier bill, but this year strongly supported the Harris-O'Hara measure. Most distributor witnesses insisted—as did the producers—that the bill was "absolutely essential" in order to assure continuing supplies of natural gas.

Principal utility spokesmen were Randall J. Leboeuf, representing Consolidated Edison Co. of New York and 11 other northeastern distributors, and John E. Heyke, president of the Brooklyn Union Gas Co.

Mr. Leboeuf testified the distributors generally believe the new gas bill is a "fair compromise" protecting gas consumers against runaway prices while also affording adequate incentives to spur gas production. "Neither the producer nor the consumer can benefit from the deadening effect of overstrict regulation," he said.

Some two score witnesses filled hundreds of pages of testimony during the four weeks of hearings in crowed committee rooms.

But in the long run, the fate of the bill rests not so much on the simple arguments for and against the bill as it does on whether the President or the producers will back down enough to get the bill through.

GAS news

3.4 trillion cu ft of gas in underground storage

Approximately 3.4 trillion cu ft of gas is stored in underground reservoirs. To store this amount of gas, the natural gas industry has spent nearly half a billion dollars.

The American Gas Association, in the sixth annual statistical report of its committee on underground storage, revealed that an estimated 1.5 trillion cu ft of natural gas in storage was available at the end of 1956. Four states—Pennsylvania, Ohio, Michigan, and West Virginia — accounted for about 70 per cent of the total. At year's end 188 storage pools with 7432 active wells were in operation.

In citing "the impressive record of rapid and continuous growth of underground storage in the U. S.," the committee report said additional areas are being developed rapidly and predicted an even more widespread geographic distribution of storage reservoirs than now exists.

Total storage capacity has been increased by 2.5 trillion cu ft since 1951 and by 1.3 trillion cu ft in the past year alone, the report disclosed. Colorado's reservoirs provide the greatest capacity — more than 1 trillion cu ft. Next in line are Pennsylvania, 425 billion cu ft; Ohio, 395 billion; Michigan, 316 billion; and Oklahoma, 264 billion. These five states comprise approximately 71 per cent of the national total of storage capacity.

An aggregate capital investment of $456 million for storage facilities was estimated, compared with $377 million a year ago and $177 million at the end of 1950.

Ten storage pools and 686 wells were added last year, over the 1956 totals of 178 pools and 6746 wells. At the end of 1950 there were 125 reservoirs containing 3853 wells devoted to underground storage.

Similar expansion is reported for compressor stations required for underground storage operations. The 83 compressor stations in 1950 with 158,173 hp had increased in 1955 to 124 with 347,835 hp, and in 1956 to 139 with 415,840 hp.

The accompanying table shows basic underground storage statistics by state for 1956.

Consumers Gas acquires Ottawa utility

With the acquisition of Interprovincial Utilities Ltd., Ottawa, Consumers' Gas Co. of Toronto has taken another step in the buildup and diversification of the market for Alberta natural gas in eastern Canada.

This new move by Consumers follows a two-year general expansion program aimed at a proper balance of gas load in industrial, commercial and residential markets. In 1956 the company acquired Shore Gas Co.'s distribution system extending to Oshawa and Bowmanville, and Provincial Gas Co. in the Niagara Peninsula.

Interprovincial will continue to operate as a local utility. John A. Spence, general manager, is continuing in that post and all local employees are being retained.

The Ottawa utility serves Ot-

BASIC UNDERGROUND STORAGE FACTS—1956

State	Number of Pools	Number of Active Wells	Number of Compressor Stations	Total HP on Compressor Stations	Maximum Gas in Storage (Mcf)	Gas in Storage, 10/31/56 (Mcf)	Input to Storage, Year Ending 10/31 (Mcf)	Output from Storage, Year Ending 10/31 (Mcf)	Maximum Day Output, Year Ending 10/31 (Mcf)	Number of New Pools Under Construction	Ultimate Capacity of New Pools (Mcf)
Arkansas	2	17	1	145	4,672,321	4,672,321	464,961	214,919	4,589	—	—
California	4	98	4	21,390	20,995,560	20,283,934	22,199,880	21,355,138	819,679	—	—
Colorado	1	1	1	3,185	3,300,016	2,760,366	2,769,492	9,126	2,937	—	—
Illinois	2	40	2	10,450	26,669,451	25,031,828	8,649,120	4,280,336	436,771	1	1,895,376
Indiana	4	121	3	2,460	7,356,016	7,352,809	1,718,817	1,616,467	56,901	—	—
Iowa	1	32	1	1,200	4,808,966	3,924,487	3,327,067	50,313	49,270	—	—
Kansas	15	669	7	19,510	63,750,773	65,733,022	24,321,853	20,904,622	359,591	—	—
Kentucky	5	256	2	8,890	20,001,737	18,798,497	6,860,490	6,571,696	161,837	—	—
Michigan	13	951	3	58,680	193,209,257	190,063,047	93,451,820	88,605,217	1,052,083	—	—
Mississippi	2	22	2	2,600	2,263,237	2,255,891	2,436,832	1,324,176	57,514	—	—
Missouri	1	15	1	1,980	1,993,230	1,500,995	1,519,808	48,813	13,296	—	—
Montana	2	126	3	4,180	15,430,282	15,021,076	3,024,376	2,984,648	34,855	—	—
New Mexico	4	88	2	2,400	55,410,279	50,748,038	5,996,642	9,831,706	68,301	—	—
New York	13	508	10	7,130	44,850,691	44,257,536	21,586,633	18,127,449	270,795	—	—
Ohio	16	1,846	18	43,692	264,565,007	261,960,472	92,253,785	77,399,209	1,108,072	—	—
Oklahoma	7	76	5	7,350	93,600,197	92,842,358	22,818,228	19,547,367	397,320	—	—
Pennsylvania	58	1,789	47	156,870	334,464,212	326,514,459	137,777,883	122,842,354	1,893,855	1	810,560
Texas	5	65	5	8,920	17,140,622	16,165,456	2,123,904	1,986,242	64,530	1	3,500,000
West Virginia	31	704	20	51,000	202,684,695	200,074,927	100,104,194	90,274,979	1,117,111	4	52,463,550
Wyoming	2	8	2	1,808	12,538,382	12,427,399	2,759,100	3,589,614	53,410	—	—
Total	188	7,432	139	415,840	1,389,704,931	1,360,388,918	556,694,885	491,564,991	8,022,717	7	58,669,486

tawa, Eastview and Rockcliffe with manufactured gas. Its plant has a maximum capacity of 1.5 MMcf/day.

Blackstone separating gas, electric operations

Blackstone Valley Gas & Electric Co., Pawtucket, R. I., has taken the first steps to split up its gas and electric business in compliance with a 1950 Securities & Exchange Commission order.

Under plans of Eastern Utilities Associations, holding company for Blackstone, the gas business would be operated by the Valley Gas Co., chartered last year.

The state public utilities administrator has received a petition from Blackstone to sell its property and assets to Valley. This petition will be held in abeyance until an SEC decision is reached on the final plan.

Work under way on OFG's Holmes storage project

Work is under way on the first phase of a $1.5 million well drilling and pipeline construction project to expand and improve Ohio Fuel Gas Co.'s Holmes underground storage area.

When completed, the project will increase the storage capacity of the Holmes area by 5.3 billion cu ft. Fifty-one production gas wells will be converted to storage wells, 10 new storage wells will be drilled, and more than 16 miles of pipeline will be laid this year at a cost of $892,000. Remainder of the work, including drilling nine additional storage wells and constructing pipelines to tie them into the storage system, is scheduled for next year.

Oklahoma Natural signs long-term gas contract

Oklahoma Natural Gas Co., Oklahoma City, has signed a 20-year contract with Sovereign Resources Inc. for an Oklahoma gas supply.

The agreement calls for Oklahoma Natural to buy all gas produced from the Ausmus and Barton leases in Creek county, Okla. Rate is 10 cents/cu ft for gas delivered prior to Dec. 26, 1957; 11 cents/cu ft for the following five years, and increases to 12 cents and then 13 cents/cu ft after 1962.

According to Sovereign's president, Allen Bronston, two gas wells on the property are presently capable of producing 11.5 MMcf/day.

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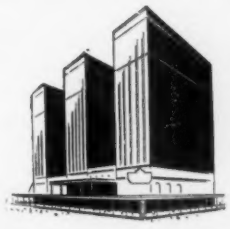

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Additional wells will soon be drilled in an effort to increase the present production.

Cities get government loan for gas system

The Community Facilities Administration has approved loans totaling $673,000 to finance a natural gas system in Kentucky. The system will serve the cities of Sturgis, Clay and Wheatcroft; the villages of Diamond and Sullivan; and rural customers along the transmission line.

The system will be built jointly by the cities of Sturgis and Clay, with Sturgis paying $425,000 and Clay $248,000.

Approval of the loans was made contingent on the inability of the applicants to obtain private financing for the project on reasonable terms.

The area to be served is located midway between Evansville, Ind. and Paducah, Ky.

Ground-breaking ceremonies were held in Anaheim, Calif., recently preliminary to immediate construction of a $250,000 Western Research Center by Robertshaw-Fulton Controls Co. An unusual feature of the center is the contemporary modern home (extreme right in photo), which will be used for environmental testing of the appliance control devices developed there.

Survey shows trend to bigger capacity heat units

A five-year study reveals that there is a strong trend toward higher capacities in gas central heating equipment.

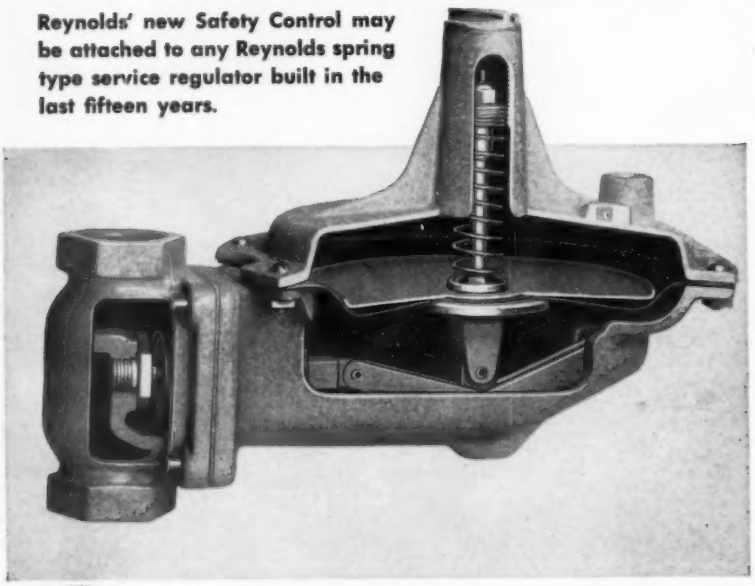
The study—conducted by GAMA—shows that in the case of both gas-fired furnaces and of boilers for residential use, a larger proportion of production has gone into units of a greater Btu input. The smallest sizes, as measured in heating capacity, show the largest declines in percentages of total output. However, sharp gains in overall production meant that in almost every classification the number of units shipped actually increased.

The study covers total production, for both new home and replacement markets, from 1952-1956.

During this five-year period, gas-fired furnaces of 75,000 or more Btu input per hour increased from 62.3 per cent of shipments to 77.2

Reynolds OFFERS A NEW PERFECTED SAFETY CONTROL FOR ALL SERVICE REGULATORS

Reynolds' new Safety Control may be attached to any Reynolds spring type service regulator built in the last fifteen years.



GAS CONTROL SINCE 1892

* **Prevent regulator from falling in a wide open position, thus limiting the amount of gas the safety seal has to pass.**
* **Enable the gas company to set the regulator for a certain demand and if a customer increases that, his outlet pressure would drop which would cause him to call the company and they can find out what his real demands are.**

REYNOLDS GAS REGULATOR CO.
ANDERSON, INDIANA

per cent. Units rated 75,000 Btu or more, but less than 100,000 Btu, accounted for 41.3 per cent of the market at latest count, up from 34.9 per cent five years ago.

By far the largest part of production involved was in furnaces of the forced warm air type, but the smaller totals, for gravity models, also were included in the survey. Shipment of 812,600 gas-fired furnaces in 1956 compares with a total of 463,700 in 1952.

In five of the six classifications for boilers rated 75,000 Btu and higher, percentage gains were shown. Virtually all the market share decline was in units under 75,000.

Particularly outstanding was the gain in boilers of 250,000-and-over Btu. The five-year percentage gain for this classification was from 11.1 per cent to 14 per cent. Because the total number of gas-fired boilers for steam and hot water heat rose in this period from 68,500 units shipped to a record 96,300 for the latest year, the numerical gain for the highest capacity category was still more impressive. Gains in the modernization market for multi-family buildings figured importantly here.

Ancient coin introduces new water heater control

Robertshaw-Fulton Controls Co. is using a Roman coin mail promotion to introduce its newly designed water heater control, the Unitrol 110.

To provide contrast while at the same time dramatizing the control's

Southern Counties Gas Co. developed this underground storage exhibit to clear up public misconceptions about gas being stored in underground caverns or voids. Walter C. Prill explains the exhibit to Lynne Mallon, secretary in the company's construction and distribution department.

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individually before shipment
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The preference that you and millions of other users have shown for the RIGID Pipe Wrench puts on us the responsibility of keeping it always up to the top quality you expect of it.
The Ridge Tool Company, Elyria, Ohio, U. S. A.

simplicity of styling, an authentic, 2000-year-old Roman coin is attached to introductory literature being sent to some 250 water heater manufacturers.

An enclosed note points out that the keepsake is an authentic coin of the type found in archeological ruins, tombs, and dredgings. Coins used in the mailing are believed to have been minted sometime between 280 B.C. and 305 A.D.

The worn and obviously ancient coin on the cover of the mailing piece serves to introduce "something brand new — also worth money to you." Inside, there is an actual-size Unitrol 110 cover and dial.

Cities regulatory power boosted by Mississippi PSC

The power of municipalities to regulate utilities within their borders has been given a boost by a Mississippi PSC ruling.

The commission has declared that Mississippi Valley Gas Co. should obtain a franchise from the City of Jackson before the PSC will grant it a certificate to operate in Jackson. The public utility law took most regulatory powers away from municipalities and placed them with the commission.

The gas company's franchise with the city expired a number of months ago.

Cascade completes financial program

Cascade Natural Gas Corp., Seattle, has completed the final phase of its 1956-57 financial program. The addition of nearly $2.25 million announced by President Spencer Clark brings to $15.3 million the amount of new financing completed by the company during the two-year period.

The funds are being used for construction of new natural gas systems and to keep ahead of accelerated customer demands for new service. "During the 1957 construction season we will continue our new construction and modernization program in all the cities Cascade serves . . . in Washington, Oregon, and Idaho," Mr. Clark said.

The latest financing was accomplished with an issue of 226,820 shares of common stock. The bulk of the issue was purchased by existing shareholders through rights.

(*Continued on page* 86)

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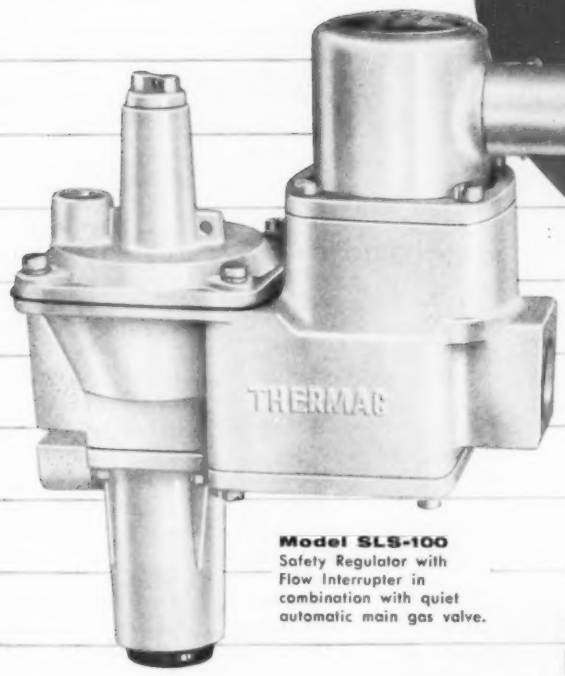

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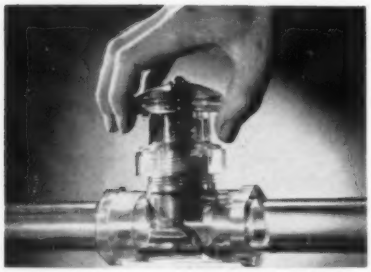
New Products and Trade Literature

For more data on any of these items use the Readers' Service Card on pages 83, 84



1. Globe-type valve

A new globe-type valve has been introduced by Sloane Manufacturing Co. It is claimed that the new valve can never rust and resists the corrosive action of many "problem" chemicals.

Made of durable Tenite butyrate plastic, the valve's interior surfaces are extremely smooth, permitting an unimpeded flow through the unit. When it is closed, a positive plastic-to-plastic seal is formed. There are no washers to deteriorate and cause downtime. And, since the valve is transparent, flow can be observed readily.

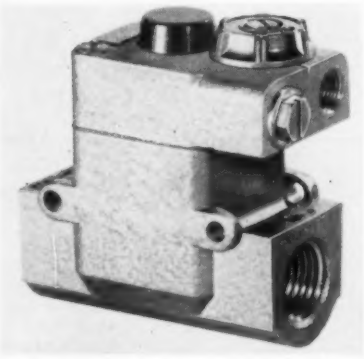
The new valve is available with either plain ends for "solvent-welding" butyrate pipe, or with threaded ends, for connecting to threaded metal and plastic pipe.
Sloane Manufacturing Co.

2. Refrigerator unit

Black, Sivalls & Bryson's new ammonia absorption refrigeration unit is for gas processing that requires temperatures below ordinary atmospheric level.

Its uses include hydrocarbon dewpoint control in pipelines, increased hydrocarbon recovery with low temperature separation units where there is no available pressure expansion, and it can be used to increase gasoline plant hydrocarbon recovery up to 100 per cent by chilling the absorption oil.

The vibration-free unit has been designed for heavy duty and continuous operation.
Black, Sivalls & Bryson



3. Safety valve

A new safety valve from General Controls offers a 4-position head that can be ordered pre-set for production line ease of attaching pilot take-off and thermocouple connections. For in-the-field replacement jobs, servicemen can adjust the head with just a screwdriver to fit existing pilot and thermocouple runs.

Features include 100 per cent safety, compactness, safe lighting, and ease of installation. The valve is available with or without pilot take-off, "B" valve, pilot adjustment and independent pilot flow. It is applicable for use on gas ranges, space heaters, clothes dryers, furnaces and other gas-fired appliances.
General Controls Co.

4. Plug valve actuator

Automation for plug valves is now available with actuators designed for automatic operation, either in existing installations or for new projects.

The new actuators, from Pantex Manufacturing Corp., feature positive complete closing and opening. The packaged assemblies are ready to attach to pipe and plug valve stem in a matter of minutes without special tools. Pantex actuators are now available in valve sizes from 1- to 8-in. pipe. Ten- and 12-in. sizes will soon be available.
Pantex Manufacturing Corp.

5. Insulating couplings

New Pesco insulating couplings, consisting of a threaded sleeve molded of Plaskon nylon within a steel sleeve, serve as dielectric connections between sections of piping on gas distribution systems.

Once installed the permanent

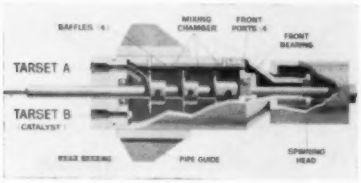
couplings are said to insure electrical isolation and eliminate corrosion, withstanding the shocks of blows and jars, bending, sidethrust and shock.

A special locking device prevents Pesco couplings from turning or slipping within their steel sleeves. They withstand pressures up to 1100 psi and remain unaffected by temperatures up to 300°F.
Plastic Engineering & Sales Corp.

6. Exhaust snubbers

New exhaust type snubbers from Burgess-Manning are particularly suitable for silencing the new turbo-supercharged type engine compressors. According to the company, they are very effective in reducing the piercing exhaust noise of the engines.

The new snubbers are of a straight-through type with a low pressure drop.
Burgess-Manning



7. Coating machine

A new machine for applying Tarset, a coal tar-epoxy resin coating, to pipe interiors has been developed by the Protective Coatings division of Pittsburgh Coke.

The applicator can lay a smooth film of Tarset on the interior of 20-ft lengths of 3-, 4-, and 6-in. pipe. In demonstrations, it achieved a 15- to 20-mil thickness in a single pass.

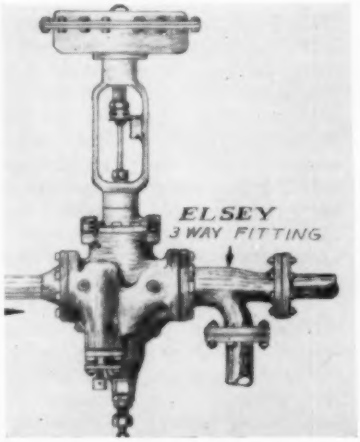
Two novel features are incorporated in the applicator: the tar-epoxy blend and its catalyst are fed separately into the applicator in carefully controlled proportions. Secondly, the mixed material is expelled from the mixing chamber under positive pressure into a spinning cylinder that centrifugally casts the Tarset on the interior surfaces of the pipe.
Pittsburgh Coke & Chemical

8. Millivoltmeter

A new self-contained, portable millivoltmeter recorder for survey work has been announced by the Bristol Co.

The instrument incorporates a wide variety of ranges. It can thus be used to study practically any condition encountered in survey work which involves the measurement of voltage and current, such as in corrosion surveys. The low ranges are used chiefly for current, employing a standard shunt, or for measuring the millivolt drop on an underground pipe or cable, of known resistance.

The recorder is offered with movement sensitivities of either 2000 or 10,000 ohms per volt.
Bristol Co.



9. Control valve

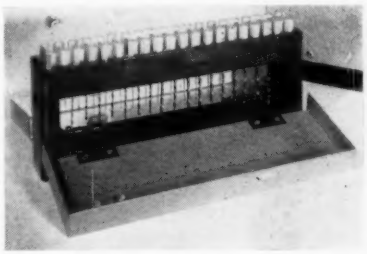
The Elsey Unit diaphragm control valve simplifies the complete conventional diaphragm control valve installation, according to the company.

The Unit valve combines in one valve body the repair and arrangement principles of the control valve together with stream flow shutoff and bypass devices. All inner valve parts are interchangeable between the Elsey Convertible diaphgram control valve and the Unit diaphragm control valve. The new Unit is designed so that the repair or replacement of valve seats or change from normally open to normally closed position can be accomplished with the valve in the line and operating under pressure.
Elsey Corp.

10. Base station

A newly designed 250-watt base station for operation in the 25-54 mc frequency range has been added to the Bendix Radio mobile radio product line.

The new station is housed in a 6-ft steel cabinet with front and rear access doors. Unitized plug-in chassis construction is featured and provides for the addition of a second receiver, local or remote control, and Quiet - Line tone squelch. All operating and tuning adjustments are accessible from the front. A built-in metering panel provides constant visual monitoring of the station in operation.
Bendix Radio Division



11. Drill set

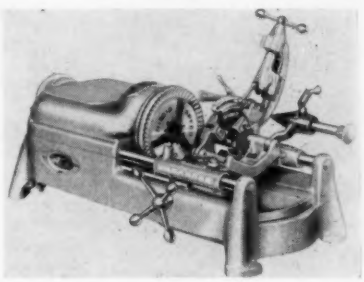
Latest addition to the Griffiths' line of tools is a complete gauging drill set with a pocket-size, all-steel case. Forty carbon steel drills with brass hex handles, No. 41 to 80, are included.

Features of the set include: drill size stamped on each drill handle; all-steel pocket-size case designed to protect sharpness and alignment of each drill.
E. F. Griffiths Co.

12. Leak detector

A new leak detector, which reportedly detects and locates a leak so small that it will admit less than 2 cu in. of gas per year, is announced by NRC Equipment Corp.

The NRC Model 4906 vacuum leak detector is a halogen- sensitive instrument offering sensitivity, stability, and quick recovery time needed to assure convenient and reliable leak detection. Besides locating leaks in high vacuum, pressure and other process equipment, the unit may be used as a quality control instrument.
NRC Equipment Corp.



13. Pipe threader

An entirely new universal die head is featured in Ridge Tool's new Ridgid 535 pipe and bolt

threading machine. The company reports that this quick-opening universal die head with its two sets of dies threads ½- to 2-in. pipe or conduit. One set of dies threads ½- to ¾-in.; the second set threads 1-, 1¼-, 1½, and 2-in.

The complete 535 package also includes the cutting and reaming tools previously available only in the Ridgid 500 and 500A. These are a roll-type cutoff with self-centering, full-floating cutter wheel and a five-flute cone reamer with ⅛- to 2-in. capacity. Operating independently, all tools swing up out of way when not in use.
Ridge Tool Co.

14. Reusable plugs

Quick-closing, fast-adjusting reusable plugs that expand in place firmly against irregularities of wall surface and shape, are available from Moeller Manufacturing Co. in round, square and many special shapes.

Two basic types are offered. The Snap-Tite, for low-pressure testing, adjusts to size with a twist of a cam lever, expands to seal all opening irregularities when the lever is depressed. The Turn-Tite adjusts with the turn of a handle, seals still more tightly against higher pressures with a further turn of the same handle.
Moeller Manufacturing Co.

15. Roast-O-Grill

Baking, roasting, grilling and steaming are possible on top of a new range from Geo. D. Roper. Called the Roast-O-Grill, the unit is built into one 36-in. model in the company's 1957 range line.

Adjustable vents in the lightweight aluminum dome, plus interchangeable parts, account for the unit's versatility. The dome, two pans, a baking sheet and rack, and a heat baffle comprise the ensemble. A bright aluminum cover fits flush with the range top when the unit is not in use, providing extra work space. According to the company, Roast-O-Grill ends the need for costly, hard-to-store special appliances and utensils.
Geo. D. Roper Corp.

16. Pneumatic controller

Taylor's new Transcope pneumatic controller provides an accurate, compact means of maintaining a given set point by relaying measured variables for subsequent correction action via a final control element such as diaphragm valve, lever motors, etc. Its inherent characteristics make it suitable for the varying time constants of modern processing and for short span measurement.

The controller makes use of the motion-balance principle through interconnected multiple bellows and springs acting on a common force plate.
Taylor Instrument Companies

17. Pipe vise

Toledo Pipe Threading Machine Co.'s new pipe and conduit vise has been designed for long, hard use. It offers a number of design improvements, according to the company.

The Toledo No. 22 vise is built with a strong sturdy frame and large diameter acme screw thread connected directly to the upper jaw for longer service. The vise yoke mounts quickly for right or left hand use.
Toledo Pipe Threading Machine

18. Tilt-crown dozer

Among new developments introduced by J. I. Case Co. is a "tilt-crown" bulldozer blade that can be tilted 14 in. to either side as well as tipped 10° fore or aft by hydraulic power.

This new feature is said to offer special advantages for ditching, road-crowning, cutting tree roots, breaking out hard ground. The blade is activated by four large hydraulic cylinders. Two cylinders mounted on the dozer pusharms control tilt and tip. The other two, trunnion-mounted on the tractor, exert down-pressure with the blade in any position.
J. I. Case Co.

19. Measurement instrument

The Atlas Probetector determines accumulations of explosive gases. Concentration of gas, below the lower explosive limit of the gaseous atmosphere in which the instrument's probe is placed, are registered on a direct-reading explosive meter.

The unit is factory calibrated for methane and ethane gases, but may be obtained with calibrations for gases. Actual percentages for specific gases are shown by calibration curves.
Atlas Laboratories Inc.

20. Talk-hear control unit

A combination talk-hear control unit takes the "desk clutter" out of mobile radio base station installations.

Made possible by transistors and miniaturized components, the RCA unit, known as Minitrol, combines in a single compact case microphone, speaker, and controls necessary for station operation of two-way radio systems. The Minitrol can be mounted on an adjustable arm over the dispatcher's desk; can be pre-set for hands-free operation; and provides a foot switch for transmitter operation.
Radio Corp. of America

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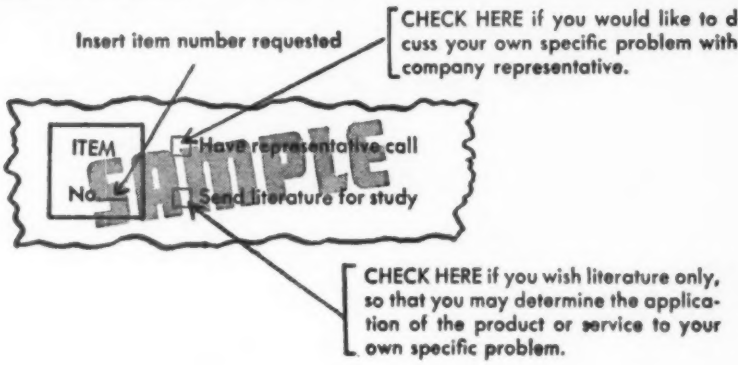
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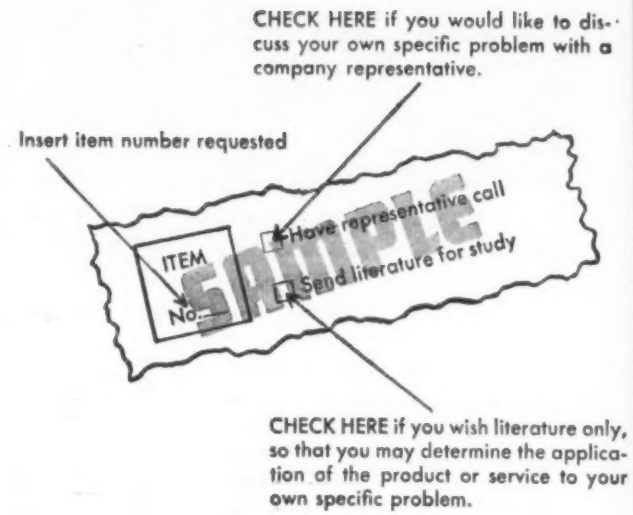
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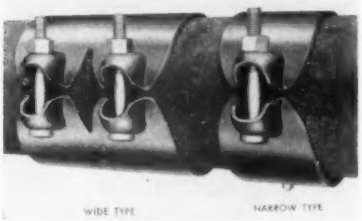


21. Repair clamp

Improved design and new manufacturing process are incorporated in a new Skinner - Seal pressed steel economy clamp. The clamp—for repairing rust holes and corrosion spots in pipelines—is now cold-formed on a 500-ton press. Heavily reinforced, "closed" lug construction is featured. The lugs are not welded to the clamp but formed from the material itself.

The width of both clamps has been increased. The narrow is now 4 in. wide, while the wide is 8¼ in. wide. Sizes start at 4-in. OD and run through all standard pipe and also cast iron pipe sizes up to 24-in. OD.
M. B. Skinner Co.

22. Thermocouple

According to Grayson Controls, its new super-clad thermocouple is interchangeable on all standard pilots.

The super-clad nickel-zinc "all over" plating protects copper from heat, prevents oxidation for more positive operation. The new thermocouple features improved thermo-electric alloys, 24 cooling fins, extended cold junction, tin plating on contact end, lock washer, and non-shrinking insulator.
Grayson Controls Division

TRADE LITERATURE

23. Semi-steel valve line

A completely revised 43-page bulletin (V-203, Rev. 1) covers the entire Rockwell - Nordstrom semi-steel valve line. New features in the bulletin include two full pages of photos, drawings and detailed description of lubricants and lubricating methods.
Rockwell Manufacturing Co.

24. Water vapor recorder

The M-S-A water vapor recorder for measuring low concentrations in streams of air or various gases for process industries and gas pipelines is described in Bulletin 0714-1 from Mine Safety Appliances Co. It explains and illustrates the principle of operation and gives typical applications.
Mine Safety Appliances Co.

25. Pressure meter

Fischer & Porter has published a catalog on the Press-I-Cell, an instrument for the precise measurement of absolute, gauge, or differential fluid pressures. The catalog describes the Press-I-Cell as measuring gases or liquids over pressure ranges from 0-40 psi to 0-1000 psi with a degree of accuracy as high as 1 part in 2000.
Fischer & Porter Co.

26. Gas regulators

Pressure regulators for industrial compressed gases are presented in a 40-page catalog from Air Reduction Pacific. Catalog 806 deals with various types of cylinder, manifold, and pipeline regulators, and a variety of specialized equipment. Flow and pressure charts in graph form give data on the performance of the regulators.
Air Reduction Co. Inc.

27. Temperature controls

The "most complete line of controls ever presented to the temperature control industry by our company" is described in White-Rodgers 1957 catalog. The 39-page, fully illustrated book includes these new controls: Fashion room thermostats, PushButton heating-cooling thermostats, combination hot water limit-circulator relay controls, a new line of farm controls, and new gas controls.
White-Rodgers Co.

28. Hot-tap valve

The Hanby hot-tap valve is designed specifically for use in tapping gas lines under pressure. The valve, also suitable as a blow-down valve for scrubbers and drips, is discussed in a folder from Oil Well Supply.
Oil Well Supply

29. Application report

The Bendix G-15d general purpose computer solved a pipeline system design problem, and the results have been published in an application report from the company. Presented are the problem, the formulae involved, data supplied, computation, and conclusions to the example problem.
Bendix Computer Division

30. Blast-hole drill

A new knee-action crawler drill from Ingersoll-Rand has been designed for use wherever rock must be drilled for blasting. Described in a four-page bulletin are its features and flexibility. The new machine is mounted on crawler tracks driven by air motors. All boom and feed-tower adjustments are hydraulically controlled.
Ingersoll-Rand Co.

31. Hole-digging truck

A pickup truck that can dig holes and lay pipe by the addition of two pieces of equipment is described in a catalog from H. S. Watson Co. The Watson-Robin digger works from a power take-off flexible shaft coming out at the rear end under the truck body. Holes up to 40 in. deep and 10½-in. diameter can be dug. The crane is mounted in a quick detachable socket well in the body floor at the rear of the pickup.
H. S. Watson Co.

32. Data processing

A report on the use of Datatron electronic data processing systems in pipeline design is contained in a new publication from Electro-Data. Presented with data on an initial segment of pipe or an initial compressor station, the Datatron calculates the outlet pressure, prints out the resulting answer, and automatically proceeds to the next segment or station. In this manner, the Datatron traverses the entire pipeline, calculating the pressures at designated points along the system.
ElectroData Division

33. Wheel ditcher

Barber-Greene's first offering to pipeliners, utilities, and contractors in the wheel ditcher field is announced in a new eight-page, two-color folder. Described in the Model 774 wheel-type ditcher. Outstanding features of the unit are discussed and illustrated. Job pictures show Model 774 at work under a variety of conditions—from spring mud to below zero temperatures.
Barber-Greene Co.

Peoples Gas System planning conversion

An $11 million expansion program to prepare Peoples Gas System, North Miami, Fla., for natural gas was announced by Phillips C. Crowen, president.

The appropriation was made by the board of directors to cover the cost of converting the system's two operating units, Peoples Water & Gas Co. and Tampa Gas Co., and extending its distribution facilities to 17 more municipalities on Florida's east coast and two more on the west coast.

"The Houston Texas Gas & Oil Corp. has said it plans to start construction of a natural gas pipeline to Florida around July 1 and expects to complete it in 12 to 14 months," Mr. Crowen noted. "Since we are Florida's largest gas utility, we want to be ready when Houston Gas is."

Peoples will have to convert the appliances of some 100,000 customers now being served through its two operating divisions. When the expansion program is completed, the present work force of 400 employees will be doubled. The System now serves 21 municipalities in Dade, Broward, and Hillsborough counties.

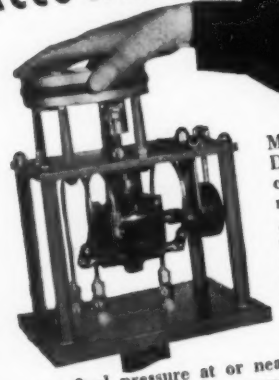
AGA lab surveys field venting conditions

Gas appliance venting data are presented on the basis of widely varying but nevertheless typical operating conditions in a new report from the AGA Laboratories.

Published as Research Report 1267, "A Field Survey of Gas Appliance Venting Conditions, Part II," the report presents a statistical analysis of draft conditions encountered in the field. It supplements data published previously in Research Report 1243. The data and analyses presented in these companion reports represent the first official industry documentation of actual venting conditions found in existing appliance installations.

ARCCO

ARCCO-Anubis CONTINUOUS GAS SAMPLER



MEETING THE DEMAND for more accurate gas sampling, this newly perfected ARCCO-Anubis instrument replaces inadequate, inaccurate spot sampling methods. The Model 100-7 will over a period of seven days accumulate at a constant rate a sample of gas to a final pressure at or near 100 psig from a sample source, the minimum pressure of which is not less than 125 psig.

The ARCCO-Anubis design is based on the principle that maintenance of a constant rate of increase in gas pressure within a closed container, from zero to any selected maximum pressure, will result in a continuous rate of flow of gas into the closed container.

This is accomplished by means of a specially designed regulation system equipped with a precision drive mechanism so as to obtain a constant predetermined rate of increase in the outlet pressure into the sample container.

Send for Bulletin No. 112-R1

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SEND FOR BULLETIN No. 112-R1

Sprague Meter Co., Bridgeport, Conn., recently memorialized its 6-millionth customer by presenting a "golden" gas meter to a new home located in the gas franchise area of the Framingham division of the Worcester (Mass.) Gas Light Co. The ceremony included the presentation by Sprague of a new Hamilton gas dryer to the lucky homeowner. Sprague president, F. Leslie Fairchild (left), congratulates Framingham division manager, Donald Story, and Worcester president, R. J. Rutherford, for spearheading the company's aggressive sales promotion efforts throughout the Worcester area.

Marvin Chandler, president of Northern Illinois Gas Co., is flanked by two Joliet, Ill., officials as they break ground for the company's new headquarters near Joliet. In back of the men is a billboard with the architect's conception of the new structure. The 20,000-sq ft building, slated for completion late this year, will house the area's operating, construction, sales, service and transportation departments. It will also provide space for the company's southern division administrative activities.

Winners in 1956 contest named by safety council

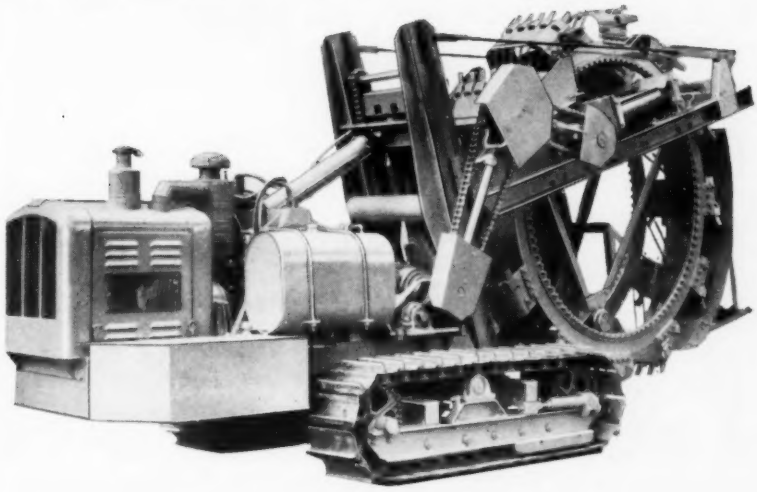
The National Safety Council has announced the winners in its annual public utilities safety contest. Of the 248 contestants completing the contest, 27 had perfect records at the end of the Jan. 1. 1956-Dec. 31, 1956, period.

The 4629 injuries in 1956 represent a 10 per cent decrease from the 1955 figure.

Contestants are divided into three categories: combination, gas, and electric.

Combination winners Group A (400,001 or more hours per month): 1st, Baltimore (Md.) Gas & Electric; 2nd, Cincinnati (Ohio) Gas & Electric; 3rd, Gulf States Utilities, Baton Rouge. Group B (200,001-400,000 hours per month): 1st, Wisconsin Public Service Corp., Milwaukee; 2nd, New Orleans (La.) Public Service Co.; 3rd, Central Illinois Light Co., Peoria. Group C (80,000-200,000 hours per month): 1st, Interstate Power Co., Dubuque, Iowa; 2nd, Iowa Southern Utilities, Centerville; 3rd, Northwestern Public

trench widths: 20 TO 32 INCHES



with NEW 170 wide-wheel Trenchliner

- **wide wheel frame — cutting widths from 20 to 32"**
- **maximum digging depth 5'9"**
- **hydraulically-driven conveyor — belt speeds independent of digging wheel speeds**
- **30 digging speeds from 12" to 25 lineal feet per minute**
- **heavy-duty cast-steel buckets**
- **double-point "Tap-In" teeth — self-sharpening, reversible**
- **quick-change gumbo buckets**
- **retractable bucket-cleaner**
- **hydraulic wheel-hoist on power-tilt mast**
- **standard tractor crawlers — 16" grouser-type treads, or 12" flat shoes optional**
- **choice of gas or diesel power**
- **all main gears enclosed in oil bath; all main shafts on antifriction bearings**

Now, another wheel-type Trenchliner joins the big Parsons line — a new 170, with extra-wide wheel frame. Developed to meet the demand for wide work range in a medium-size machine, it digs up to *32 inches wide,* at depths to 5¾ feet. With all this extra capacity, you get smooth, positive wheel control.

Hydraulic power raises and lowers the wheel on vertical mast with fractional-inch accuracy — and tilts the mast for traveling or trailer-loading. New hydraulic control system on conveyor gives belt speeds up to 600 feet per minute — *completely independent of digging wheel speeds.* Belt easily handles maximum yardages from the extra-wide wheel — puts spoil bank well back beyond edge of trench. Better have Parsons distributor demonstrate what this new 170 will do for you!

Other sizes range from a smaller wheel model to "big-inchers" and "middle-inchers" — also, ladder-types on crawlers, and on rubber.

mail to: PARSONS Company, NEWTON, IOWA

Send us more information on new 170 wide-wheel Trenchliner

NAME..... TITLE.....

COMPANY..... DIV.....

STREET.....

CITY..... STATE.....

GAS P783

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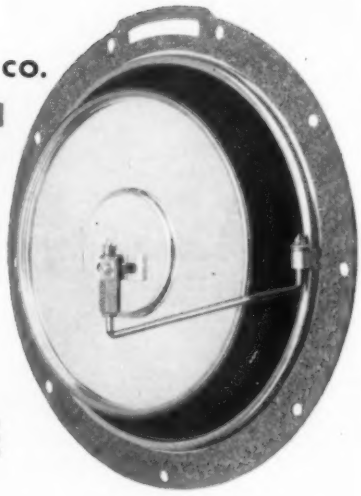
A DIVISION OF KOEHRING COMPANY

Lancaster METER PARTS CO.

FIRST



WITH SUCCESSFUL SYNTHETIC DIAPHRAGMS for 1-A SPRAGUE GAS METERS

Lancaster S-700-L Synthetic Diaphragm

Years of research and testing have produced a material and diaphragm construction that withstands excessive flexing — a vital necessity for Sprague or Ironclad meters.

Lancaster Synthetic diaphragms have no cloth lining to cause restrictions, leaks or breakdowns.

No other material tested approaches the flexibility and low differential of the Lancaster S-700-L Synthetic diaphragm. The adjustable carrier wire and special center bracket are attached to the diaphragm—for the first time it is possible to center the synthetic diaphragm perfectly and adjust it to thick or thin meter cases.

Change to the Lancaster S-700-L now for your 1-A Sprague Meters.

S-700-L Synthetic Diaphragm comes complete with carrier wire and gasket attached. Can be furnished without gaskets cemented to flange.

Not recommended for manufactured gas

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Manufacturers of Quality Parts for Gas Meters

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Service Co., Huron, S. D. Group D (5000-80,000 hours per month): 1st, Lake Superior District Power Co., Ashland, Wis.; 2nd, Superior (Wis.) Water Light & Power Co.; 3rd, City Utilities of Springfield, Mo.

In Group A of the gas division (300,001 hours or more per month), the Pittsburgh Group of the Columbia Gas System was 1st; Hope Natural Gas Co., Charleston, W. Va., 2nd; and the Columbus (Ohio) Group of Columbia was 3rd. Group B (140,001-300,000 hours per month): 1st, Peoples Natural Gas, Pittsburgh; 2nd, United Gas Corp. Texas district; 3rd, Equitable Gas, Pittsburgh. Group C (45,001-140,000 hours per month): 1st, New York State Natural, Pittsburgh; 2nd, Michigan-Wisconsin Pipe Line Co., Detroit; 3rd, Wisconsin Natural Gas Co., Racine.

Five contestants in Group D (5000-45,000 hours per month) had perfect records. They are Winnipeg (Canada) Central Gas; Gas Light Co. of Columbus, Ga.; Water Gas Treatment Dept. of Duluth, Minn.; River Gas, Marietta, Ohio; and Northampton (Mass.) Gas Light Co.

Better Copy Contest winners announced

The Public Utilities Advertising Association has honored 94 utilities for outstanding advertising prepared during 1956. Award certificates were presented at the group's 36th annual meeting in Cleveland.

More than 2000 entries were received in this year's PUAA Better Copy Contest, and a total of 189 awards were presented by Frank C. Lietz, advertising manager of Northern Illinois Gas Co., who served this year as chairman of the contest.

Northern States Power Co., Minneapolis, led the winners with seven awards. Consolidated Edison Co. of New York was second with six.

Seven companies — Cincinnati (Ohio) Gas & Electric, Cleveland (Ohio) Electric Illuminating, East Ohio Gas (Cleveland), Laclede Gas (St. Louis), Pacific Gas & Electric (San Francisco), South Jersey Gas (Atlantic City), and Wisconsin Public Service (Green Bay)—each received five awards.

Six companies received four awards each. They are Commonwealth Edison (Chicago), Hartford (Conn.) Gas, Houston (Texas)

Natural Gas Corp., Indianapolis (Ind.) Water Co., Southern Union Gas (Dallas), and Virginia Electric & Power (Richmond).

Three awards were received by British Columbia Electric (Vancouver), Connecticut Light & Power (Hartford), Hartford (Conn.) Electric Light, Hawaiian Electric (Honolulu), Minneapolis (Minn.) Gas Co., New Orleans (La.) Public Service, Texas Eastern Transmission (Shreveport), Union Electric (St. Louis), and Washington Water Power (Spokane).

In addition, 20 companies picked up two awards each, while 50 companies received one each.

GAS news notes

The Pennsylvania Public Utility Commission has authorized Pennsylvania Gas Co., Warren, to extend its system to new areas in Erie county. The $700,000 expansion will enable the company to provide service to the boroughs of Girard, Platea, Cranesville, and Albion, in adition to areas in Elk Creek and Conneaut townships.

More than 8 per cent of the ranges shipped so far this year are built-ins, according to GAMA. Both free-standing and built-in ranges were shipped in smaller numbers in April than in April 1956, but built-ins are ahead of 1956 for a four-month period.

United Pipe Line Contractors Inc., Beloit, Wis., has merged with United Pipe Utility Suppliers Inc. Officers of United Pipe Line are Eugene Alters, president; John Koch, vice president; John Alters, vice president; J. Richard Stanton, secretary; and Theodore Johnson, treasurer.

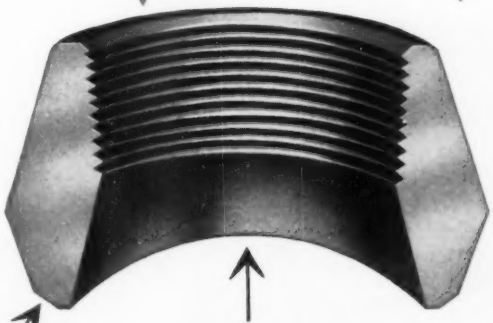
Brosey Engineering Co., Indianapolis, has been appointed representative for the state of Indiana by Ledeen Manufacturing Co., El Monte, Calif.

New distributors of Polyken protective tape coatings have been named by Polyken Sales Division. They are Farwest Corrosion Control Corp., Seattle, with a branch office in Los Angeles; William Cluff Corp., Tulsa, covering the Southwest and Rocky Mountain area; and Aetna Sales Co., San Francisco.

HOUSE CONNECTIONS
on NEW steel distribution mains

NEW GAS COMMUNITIES

STEEL REPLACEMENT OF CAST IRON MAINS



SHAPED TO FIT
BEVELED FOR WELDING
SPECIFY AND USE

RUGGED
FOR PERMANENCE AGAINST EXTERNAL FORCES AND CORROSION

FAST
INSTALLATION IN THE STREETS WHERE MINUTES COUNT

BONNEY THREDOLETS

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WELDOLETS ®
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BONNEY FORGE & TOOL WORKS
DEPT. B., ALLENTOWN, PENNSYLVANIA

GAS

associations

O'Brien succeeds Herrmann as head of TIPRO

Jerome J. O'Brien, vice president and manager of mid-continent operations for Monterey Oil Co., was elected president of the Texas Independent Producers & Royalty Owners Association at the group's 11th annual meeting held recently in Galveston.

Ridley Wheeler, independent oilman of Fort Worth, was named secretary; Vance Foster, vice president of the First National Bank in Dallas, was reelected treasurer; and Harry C. Jones, vice president of Carter-Jones Drilling Co., Kilgore, was elected state membership chairman.

Mr. O'Brien succeeds A. E. Herrmann of Amarillo, who was presented a plaque honoring him for his service as president of the association.

Parkes and Carpenter get AGA appointments

Ed Parkes, executive vice president of United Gas Corp., has been named chairman of the AGA committee on natural gas reserves. He succeeds the late N. C. McGowen, who had served as chairman of the committee since its formation in 1946.

Orville S. Carpenter, president of Texas Eastern Transmission Corp., has been elected to the board of directors of AGA. He fills the unexpired term of George T. Naff, vice chairman of the same company, who resigned from the board.

Wisconsin utility group names Nemeyer president

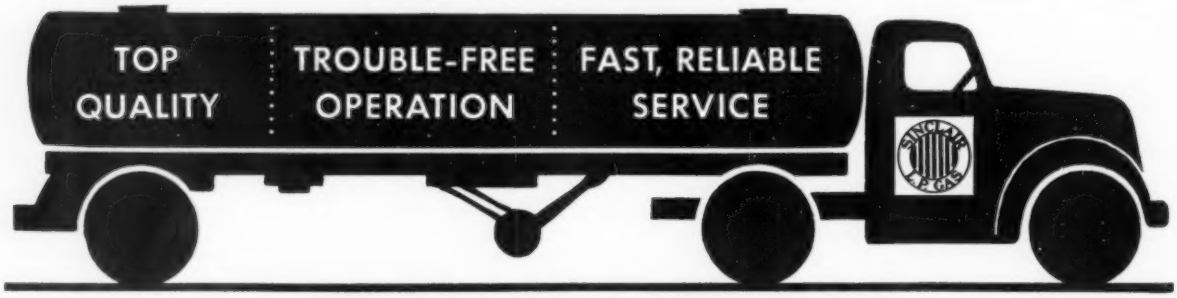
S. Lloyd Nemeyer, president of Milwaukee Gas Light Co., has been elected president of the Wisconsin Utilities Association. He succeeds R. W. Leach, vice president of Wisconsin Electric Power Co., who becomes board chairman.

Other officers are Stuart V. Willson, president of Northern States Power Co., vice president; and Earl G. Frank, Milwaukee Gas Light, who was reelected treasurer.

GAS association notes

Gas Appliance Manufacturers Association will not sponsor a 1958 Atlantic City exhibition during the annual convention of the American Gas Association. The decision followed a poll of the membership, which showed that members were not in favor of sponsoring the exhibit.

O. W. Brewer, controller and assistant secretary of the American Gas Association, has retired after 35 years of continuous service. Robert J. Cutting succeeds him as controller. Mr. Cutting will retain the post of office manager which he has held since joining the AGA staff as auditor and office manager in July 1956.



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Sinclair's vast facilities—natural gasoline plants, refineries, storage plants, tank cars and trucks—are at your service when you use Sinclair's famous LP Gas in your installations. What's more, you have the know-how of experienced Sinclair engineers on call at all times, ready to solve *your* problems. For uniform high quality of product, trouble-free operation and prompt dependable service, switch to Sinclair Butane-Propane today.

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Liquefied Petroleum Gas Sales Department
Sinclair Oil Building, Tulsa, Oklahoma

SINCLAIR
A Great Name in Oil

GAS people

Robert Ramsdell
East Ohio

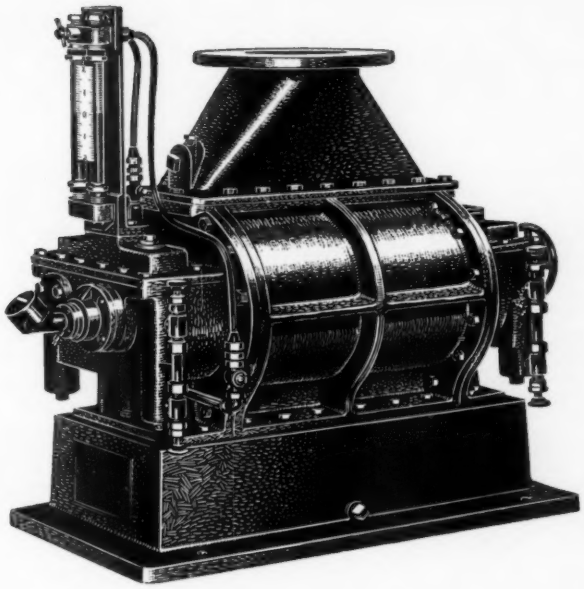
William Rogers
East Ohio

ROBERT W. RAMSDELL is now president and chief executive officer of the East Ohio Gas Co., Cleveland, WILLIAM G. ROGERS, who has served as president since 1951, is chairman of the board. Mr. Rogers will continue to be active in the management of East Ohio's parent company, Consolidated Natural Gas Co., of which he is a member of the board of directors and the executive committee. Mr. Ramsdell, executive vice president of East Ohio since 1956, began his career in the company's distribution and service headquarters in 1928. In 1951 he was elected vice president.

Climaxing his 45 years in the public utility field, L. B. SCHIESZ is now chairman of the board of Indiana Gas & Water Co., Indianapolis. HERMAN G. HORSTMAN succeeds him as president. Mr. Schiesz started as an accountant in the utility industry. He was vice president and director of the former Central Indiana Power Co. and affiliated companies in 1923 and president from 1937 to 1941, when he became first vice president and director of Public Service Co. of Indiana. When Indiana Gas & Water was organized in 1945, he became president and director. Mr. Horstman joined Indiana Gas in 1955. Before that he was assistant to the presi-

L. B. Schiesz
Indiana Gas

H. G. Horstman
Indiana Gas



R-C rotary positive displacement meters retain "cash register" accuracy

For utility metering or proportioning of process gas, Roots-Connersville rotary gas meters assure permanent accuracy unmatched by any other design.

- 15:1 accurate operating range.
- Accuracy is not affected by variations in specific gravity, rate of flow, pulsations or impurities.
- Precision machined measuring chambers insure maintenance-free accuracy.
- No valves, diaphragms or other small parts are used, eliminating leakage due to wear.

R-C meters will meet your most exacting requirements in capacities from 2,000 to 1,000,000 cfh. Write for Bulletin M-152 for complete specification details.

Engineers—unusual career opportunities await you at Roots-Connersville. Address your resume to Professional Employment Manager.

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

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What's inside makes a big difference!

A hole in your meter diaphragm means lost accuracy.

Vulcan Synthetic Diaphragms stay dependably gas-tight – won't dry out or crack – need no lubrication.

Vulcan is the pioneer in the synthetic diaphragm field – and stays ahead with ultra modern facilities for development and manufacturing.

Specify Vulcan . . . and be sure

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Vulcan Rubber Products Division

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Gas Meter Diaphragms
Diaphragms for Regulators & Controls

C. J. Kentler Jr.
Rockwell

Charles Goff Jr.
Rockwell

George Justin
Peoples Gas

John Bills
Peoples Gas

dent of Texas Gas Transmission Corp. FRED W. DOPKE, who has been vice president of Indiana Gas, is now first vice president.

Two district sales managers have been named by Rockwell Manufacturing Co's meter and valve division. DR. CHARLES J. KENTLER JR. is manager of New York district and CHARLES B. GOFF JR. is managing the Pittsburgh district office.

Several appointments have been made by Peoples Gas System, North Miami, Fla. GEORGE V. JUSTIN, formerly of Providence (R. I.) Gas Co., has been named director of operational planning. JOHN T. BILLS will serve as director of advertising and public relations, SAMUEL H. EWING, former district manager for the Peoples Water & Gas Co., has been assigned to the system staff as business development specialist.

Three executives of Arkansas Louisiana Gas Co., Shreveport, have been elevated to newly created vice presidencies. They are E. N. HENDERSON, Chief engineer since 1954; B. E. HARRELL, who serves as manager of gas supply and sales; D. W. WEIR, who has served as assistant to the president.

F. D. CAMPBELL, president of New England Gas & Electric Association since 1938, has been elected chairman of the board of trustees. JOHN F. RICH succeeds him as president and chief executive officer. Mr. Campbell will continue on a full-time basis until his retirement in September. Thereafter he will act as chairman and consultant.

Several executive appointments have been announced by Milwaukee (Wis.) Gas Light Co. LLOYD J. KLEIN is vice president of economic planning and research, a new position. EARL G. FRANK as secretary will succeed PAUL J. IMSE upon his retirement Nov. 1. FRANK LIPSKY succeeds Mr. Frank as assistant treasurer.

Iroquois Gas Corp., Buffalo, has promoted RICHARD C. KNACK to head of the Niagara Falls service center. WALTER LEE succeeds him as district manager at Arcade.

FRED M. ODOM JR. has been elected a vice president of United Gas Corp., Shreveport. He succeeds J. H. MIRACLE, who recently was elected treasurer and continues as a vice president. B. M. BYRD is now secretary of United Gas.

WILLIAM L. LITLE is now chairman of the board and president of Bucyrus-Erie Co., South Milwaukee, Wis. With the company 31 years, Mr. Litle has been president since 1952. In other management

D. W. Weir
Ark-La

B. E. Harrell
Ark-La

E. N. Henderson
Ark-La

John F. Rich
NEGEA

W. L. Litle
Bucyrus

Dan Gannon
Mueller

changes, LYLE S. CLINE was elected vice president and secretary and DAVID W. HARRIS was elected vice president. WILLIAM W. COLEMAN was named honorary chairman of the board. His retirement as chairman of the board and of the executive committee comes after 52 years of association with the company. ALBERT S. PUELICHER, a Milwaukee banker, was elected chairman of the executive committee.

DAN R. GANNON is field sales manager of Mueller Co. He will headquarter in Decatur, Ill. Mr. Gannon most recently has been western sales manager for Mueller.

The new San Francisco office of Ebasco Services Inc. is managed by HARVEY K. BRECKENRIDGE. He has been with Ebasco since 1954.

Brooklyn (N. Y.) Union Gas Co. has elected GORDON C. GRISWOLD vice president and treasurer of the company. Mr. Griswold, who was elected a vice president of the company last year, became treasurer as well, succeeding MORTON O. DAVIS, who has retired.

G. M. ROCK has become assistant secretary and treasurer of the Minnesota plant of Koppers Gas & Coke Division in St. Paul. He succeeds R. J. WHEELER, who has retired after 39 years of service with Koppers Co. Inc.

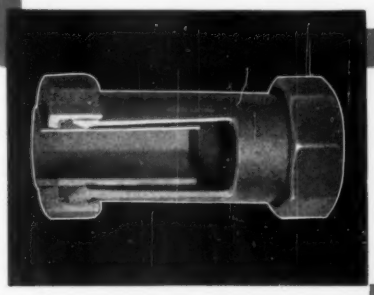
RAY MCWHORTER has joined SINCLAIR SPENCE as Fisher Governor Co. sales representative in Venezuela. The territory will be divided between Spence in the Caracas area and McWhorter, who will set up an office near Lake Maracaibo.

LYSLE R. KIRK is now chief geologist for Ohio Fuel Gas Co., Columbus. He succeeds KENNETH C. COTTINGHAM, who has retired.

NORMAC

Couplings, Sleeves and Fittings for ☆ UNIFORMITY ☆ DEPENDABILITY ☆ ADAPTABILITY

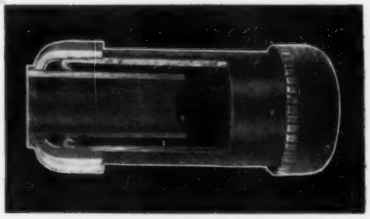
Normac gas distribution products are engineered and manufactured to meet every requirement of modern gas distribution. Write today for catalog.



NORMAC COUPLINGS
Normac malleable couplings and sleeves offer the ultimate in deflection and strength with a center wall thickness greater than the wall thickness of the service pipe on which they are used. Every Normac fitting is individually air tested.

COMPRESSION-END "ELLS"
Normac ells of all types incorporate every feature of the Normac coupling plus full coupling depth.

COMPRESSION-END SERVICE "TEE"
Full coupling depth. Special threads on male end prevent dropping into old hand taps.



NORMAC #50-A STEEL COUPLINGS
Manufactured from extra heavy wall pipe. Couplings are available with either seamless or welded centers in sizes from ¾" to 1½" inclusive. 10" and special length centers available.

Normac also manufactures a complete line of red brass fittings in O.D. sizes: ⅝", ⅞", 1⅛", 1⅜"—and a complete line of insulated couplings and fittings.

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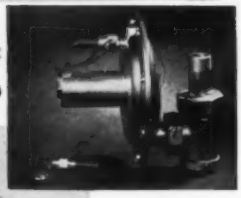

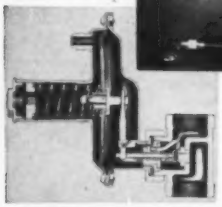

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people • *Continued*

Mr. Kirk has been with Ohio Fuel for 21 years, starting as a clerk in the gas engineering department of the Columbia Gas System Service Corp.

JOSEPH W. GREENE has been elected vice president of sales for Crane Co., Chicago. He moves up from his post as director of industrial sales. Mr. Greene is succeeded in his former post by CHARLES W. LOVELACE. Mr. Lovelace has been manager of the company's valve and fitting department.

RICHARD B. BARGER, formerly eastern regional executive of General Controls Co., has rejoined Hartford (Conn.) Gas Co. He will serve as heating and air conditioning sales manager, a newly created post.

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LOOSENS rusted bolts, nuts, screws, 'frozen' parts

Liquid Wrench works *fast*... yet is absolutely safe for all metals and alloys.

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Charlotte, North Carolina

Two accounting department promotions have been made by Houston (Texas) Natural Gas Corp. WILLIAM G. HAND, chief accountant of Houston Pipe Line Co. since it was acquired by Houston Natural last year, is now controller. MICHAEL C. GAINES JR., chief accountant, was named assistant controller.

E. C. SAUNDERS has been named to the newly created post of customer accounting supervisor of San Diego (Calif.) Gas & Electric Co. He has been serving as district office accounting supervisor.

MEREDITH L. ADDY has been named purchasing agent of John Wood Co.'s heater and tank division, Conshohocken, Pa. The company has also appointed DON GIBSON district sales representative in the Cleveland, Ohio, area.

GERALD T. MILLIN was elected president of Minneapolis (Minn.) Gas Co. He succeeds HARRY K. WRENCH, who retired as president but continues as a director.

JOHN J. CARROLL has been elected a vice president of Neptune Meter Co., New York. He succeeds WENTWORTH SMITH, who has been named executive in charge of all meter operations for Neptune.

MORRIS P. STILLINGER has been named assistant sales manager of the appliance controls division of General Controls Co., Glendale, Calif. He formerly served as sales engineer in the company's Los Angeles branch office.

DON FRICKER has been named general supervisor, industrial advertising and sales promotion, for the J. I. Case Co., Racine, Wis. Also, W. M. DREIER, former sales vice president of Massey-Harris-Ferguson Ltd., has joined Case as a sales executive.

NEELE E. STEARNS, president of Crane Co., Chicago, since Jan. 1, has been elected to the firm's board of directors. The election fills the vacancy on the board left by the death of DAVID LEVINGER.

NOBLE D. TRAVIS has been appointed director of public relations of Michigan Consolidated Gas Co., Detroit. Mr. Travis joins the company after 27 years with the De-

N. D. Travis
Mich Con

E. G. Campbell
Perfex

troit Trust Co. where he was vice president in charge of public relations since 1945. WILLIAM M. HUTCHINS, who has been director of public relations in the company's outstate districts since 1951, is now director of press relations. Michigan Consolidated has also announced the election of RAY R. EPPERT to the board of directors. Mr. Eppert is executive vice president of Burroughs Corp.

ERNEST G. CAMPBELL has joined Perfex Plastics Inc., Chicago, as a manufacturer's representative. Mr. Campbell, identified with the gas industry for 37 years, has retired as general superintendent of distribution for the Peoples Gas Light & Coke Co.

WILLIAM A. GREEN, executive vice president of MidSouth Gas Co., Little Rock, retired in June after 35 years with MidSouth and predecessor companies. He will stay active with the company in an advisory and consulting capacity.

Deaths

W. T. STEVENSON suffered a fatal heart attack at his home in Owensboro, Ky. on May 22. Mr. Stevenson was president of Texas Gas Transmission Corp., chairman of the board of its wholly owned production subsidiary, Texas Gas Exploration Corp., president of Western Kentucky Gas Co., and

W. T. Stevenson

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BROKEN PIPES REPAIRED *in minutes!*

For permanent repair, simply install beside break, slide over, and tighten . . . Stainless Steel bands. Neoprene Gaskets. Write for literature.

Adams PIPE REPAIR PRODUCTS
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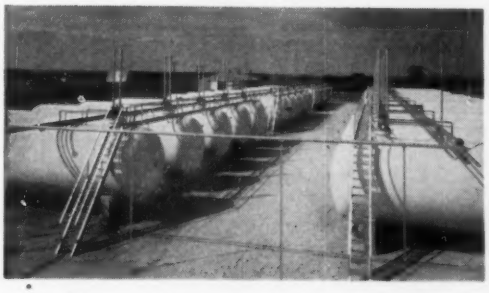
DRAKETOWN

PROPANE PLANT OF THE MONTH



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Peak Shaving and Standby Plant for Iowa Power & Light in Des Moines. Complete design and construction by Draketown. Supplements and substitutes for natural gas, will reduce demand charges. Plant pays for itself in one year.

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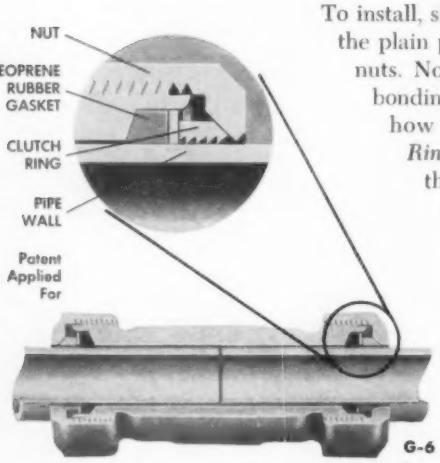
Get and Hold
a Sure Grip!

Be sure! Save time and money by specifying and using *Telsco Compression Fittings* for every connection. No threading, flaring or bonding. You'll be glad you used *Telsco* for faster, tighter connections.



To install, simply slip the fittings onto the plain pipe ends, and tighten the nuts. No threading, no flaring, no bonding. The cross section shows how the new *Telsco Clutch Ring* gets a vise-like grip on the pipe when the nuts are drawn up. The *Neoprene Rubber Gasket* tightly seals against all leaks.

Your favorite jobber has a complete line of Telsco Compression Fittings. Why not see him *today!*

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ENGINEERING, INSTALLATION
Anchor's Engineering Dept. will design and supervise plant construction.

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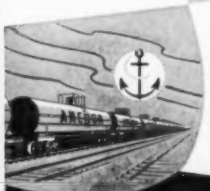
Anchor's experienced staff will assist with the financial details.



SUPPLIES
Huge tank car fleet, many plants and vast underground storage assure adequate supplies.

ANCHOR
PETROLEUM COMPANY
TULSA — CHerry 2-7261

people • *Continued*

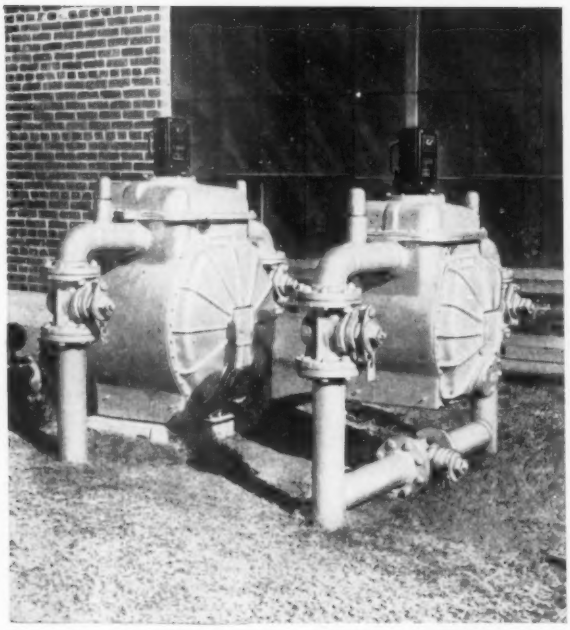
president of its wholly owned L. P. gas subsidiary, Kengas Inc. At the time of his death, Mr. Stevenson was serving as a vice president and member of the board of directors of the Independent Natural Gas Association of America. He had been a director of the American Gas Association. In 1928 as an employee of a firm of public accountants, he was assigned to do work for early predecessor companies of Texas Gas. The following year he accepted a position with them. When Kentucky Natural Gas Corp. was formed in 1933, he was elected its assistant treasurer. When Texas Gas was formed in 1945, Mr. Stevenson was made an officer and director of it. In 1948 he was named executive vice president, and in 1951 was elected president.

ART THEOBALD, chief engineer for Sequoia Manufacturing Co., San Carlos, Calif., died recently. Always active in industry affairs, Mr. Theobold helped organize and was a charter member of the Institute of Heating & Air Conditioning Industries, a chapter president of the American Society of Heating and Air Conditioning Engineers, chairman of the western working committee of the AGA, a member of the technical committee of GAMA, chairman of the northern California manufacturers section of PCGA, and a charter member of the Gas Development Engineers' Society.

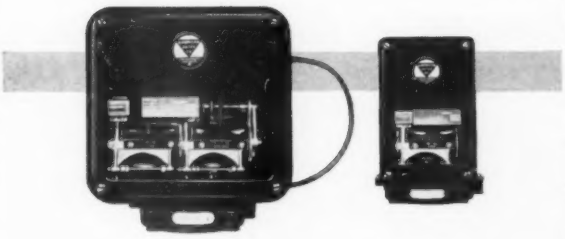
ROBERT H. PHILIPPS JR., retired general manager of the gas department of Public Service Electric & Gas Co., Newark, N. J., died recently in Los Angeles. Mr. Philipps, who retired three years ago, joined PSE&G in 1911. In 1938 he was named general superintendent of gas manufacture and in 1947 he became general manager of the gas department. He held that position until his retirement.

B. H. WINHAM, secretary of United Gas Corp., died in Shreveport recently. Mr. Winham, who was named secretary in 1951, had been associated with the company 26 years.

CHARLES A. DUFFY, manager of commercial buildings department, Consolidated Edison Co. of New York, died recently.



Temperature and pressure compensated metering continuously and automatically



American® BASE VOLUME INDEXES register gas quantity at standard conditions of base temperature and base pressure. BASE PRESSURE INDEXES automatically multiply volume at pipe line conditions by the pressure factor and indicate quantity at base pressure on a straight reading index.

Operation of both instruments is continuous with all functions performed mechanically through special gearing. Indicated totals are always accurate.

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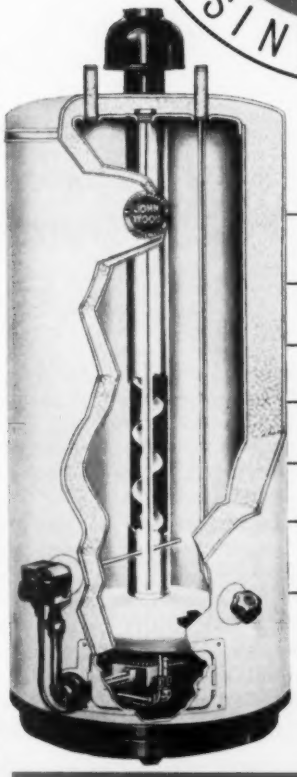

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- **Off-Center Flue** Travels the Heat Further
- **Extra Heavy Tanks**
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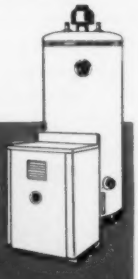

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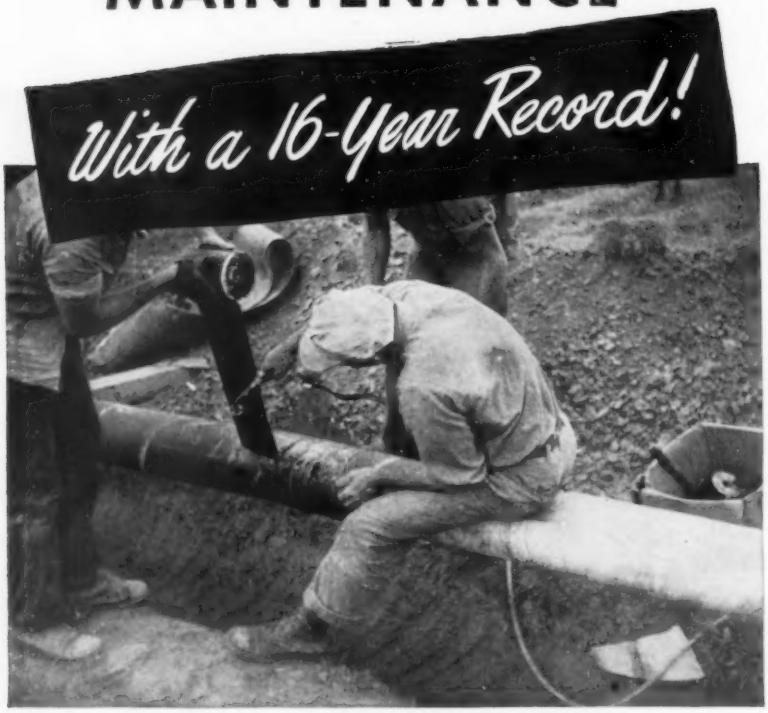

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GAS calendar

September

3- 5. Pacific Coast Gas Association Annual Convention—San Francisco.

6. New Jersey Gas Association Annual Meeting—Spring Lake, N. J.

9-10. INGAA Annual Meeting—Shamrock Hilton Hotel, Houston, Texas.

9-13. AGA Industrial Gas School—Hotel William Penn, Pittsburgh.

10. New England Gas Association Safety Conference — Sheraton-Plaza, Boston.

10-12. Mid West Gas Association Gas School and Conference—Iowa State College, Ames.

11-13. National Petroleum Association 55th Annual Meeting—Traymore Hotel, Atlantic City.

12. NEGA Residential Sales Division —Boston Gas Co., Boston.

13-14. Maryland Utilities Association 33rd Annual Fall Conference—Cavalier Hotel, Virginia Beach, Va.

16-18. AGA 9th Annual Accident Prevention Conference — St. Louis, Mo.

18-20. Southeastern Gas Association Convention—Robert E. Lee Hotel, Winston Salem, N. C.

20. AGA Great Lakes Public Relations Workshop—Hotel Statler, Detroit.

23-25. American Society of Mechanical Engineers—Statler Hotel, Hartford, Conn.

27. NEGA C-H-I Division—Wachusett Country Club, West Boylston, Mass.

October

1- 2. Texas Mid-Continent Oil & Gas Association 38th Annual Meeting—Texas Hotel, Fort Worth.

7- 9. AGA Annual Convention—Kiel Auditorium, St. Louis, Mo.

10-11. California Natural Gasoline Association Annual Fall Meeting—Huntington-Sheraton Hotel, Pasadena.

16-18. Wisconsin Utilities Association Gas & Electric Operation and Sales Sections Convention — Schroeder Hotel, Milwaukee.

21-25. National Safety Council—Conrad Hilton Hotel, Chicago.

23. NEGA Accounting Division — Sheraton-Biltmore, Providence.

November

6. NEGA Operating Division—Hotel Statler, Hartford, Conn.

11-14. American Petroleum Institute—Conrad Hilton Hotel, Chicago.

13-15. ASA 8th National Conference on Standards and 39th Annual Meeting—San Francisco. .. ..

14-16. American Society of Refrigerating Engineers Semi-Annual Meeting—Shoreland Hotel, Chicago.

18-19. SGA Annual Advisory Council & Management Conference—Point Clear, Ala.

18-22. National Warm Air Heating & Air Conditioning Association—Hotel Morrison, Chicago.

December

1- 6 American Society of Mechanical Engineers Annual Meeting—Hotel Statler, New York.

1958

January

23. NEGA Operating Division—Hotel Statler, Boston.

March

17-21. National Association of Corrosion Engineers—San Francisco.

20-21. New England Gas Association Annual Meeting—Hotel Statler, Boston.

24-26. Mid-West Gas Association—Broadmoor Hotel, Colorado Springs.

31-April 2. GAMA Annual Meeting—The Greenbrier, White Sulphur Springs, W. Va.

31-April 2. AGA General Management Section Conference—Washington, D. C.

April

8-10. AGA Sales Conference on Industrial & Commercial Gas—Hotel Schroeder, Milwaukee.

14-16. National Conference of Electric & Gas Utility Accountants—Shamrock-Hilton Hotel, Houston.

28-30. Southern Gas Association Annual Convention—Dallas.

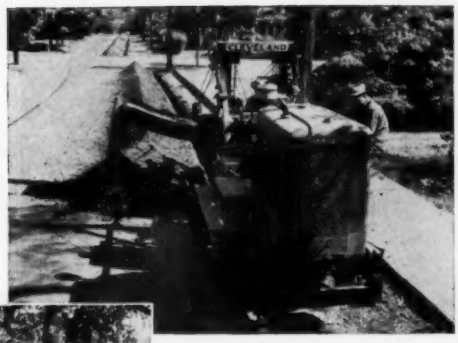
May

5- 9. AGA Distribution, Production, and Transmission Conference—Roosevelt and Commodore Hotels, New York.

19-21. AGA Mid-west Regional Gas Sales Conference—Edgewater Beach Hotel, Chicago.

22-24. Pennsylvania Gas Association Annual Meeting—Pocono Manor Inn, Pocono Manor, Pa.

DIGS STRAIGHT



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Etowah Construction Company uses its Cleveland 95's compactness and shiftable conveyor to advantage on this utilities job in Franklin, Tennessee.

The Cleveland 95 "Baby Digger"—built by the Pioneers of the Modern Trencher, originators of *every* important trencher design feature—makes money for its owners because it . . .

- ***fits more jobs***—digs to 5½′ deep x 24″ wide.
- ***digs all soils***—full-size engine, over 30 graduated power and speed combinations.
- ***digs faster***—more bucket capacity, more wheel-and-crawler combinations.
- ***saves property damage***—full crawlers, easy on lawns and sidewalks.
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LOWERING THE COST
Barrett's experience and Technical Service make sure your coated and wrapped pipe goes into the ground at minimum cost. You can count on top protection and long life with Barrett Primer, Coal-Tar Enamel and Pipeline Felt. Barrett Enamel, with its inherent properties, substantially cuts the cost of cathodic protection. Over-all lowest cost is assured with the Barrett Group's assistance and advice from start to finish. Write for information.
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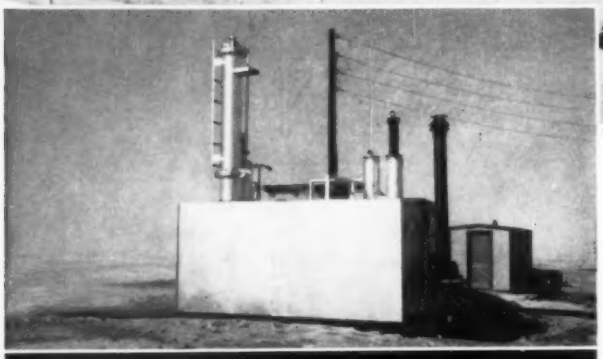
Radio network aids integrated gas system

NATIONAL GLYCOL DEHYDRATION AND LOW TEMPERATURE EXTRACTION (LTX®) Equipment



National 500 mcf/day, 125 # WP Glycol Dehydrator — N. Dakota

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A 30" x 12½', 1200 psi LTX with Glycol Injection and a 24" x 15', 300 psi Stabilizing Desorber for 10,000 mcf per day operating on lease in South Texas.

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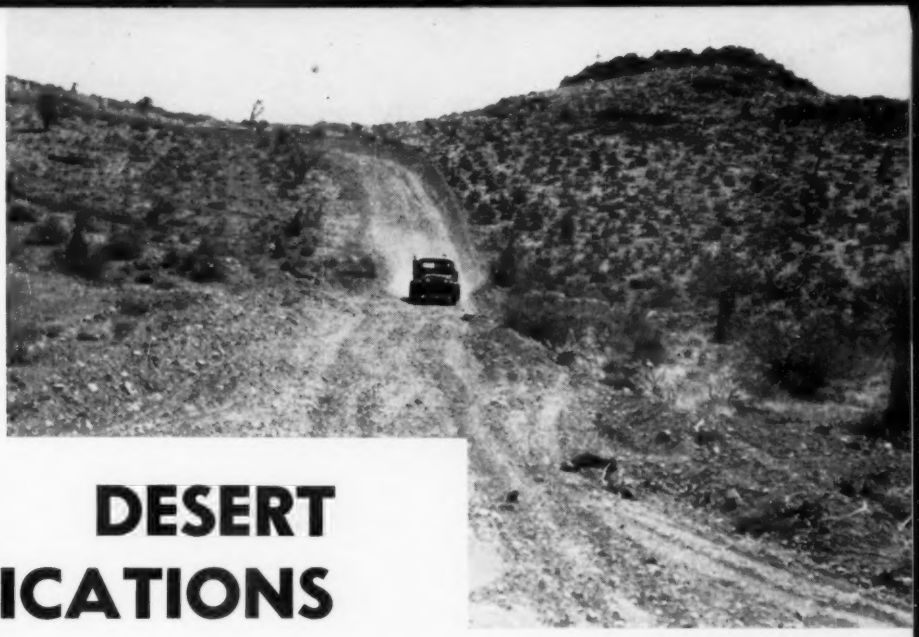


Terrain such as this is typical on Nevada Natural's pipeline route. Communication system efficiency and reliability are vital in this rough country.

DESERT COMMUNICATIONS

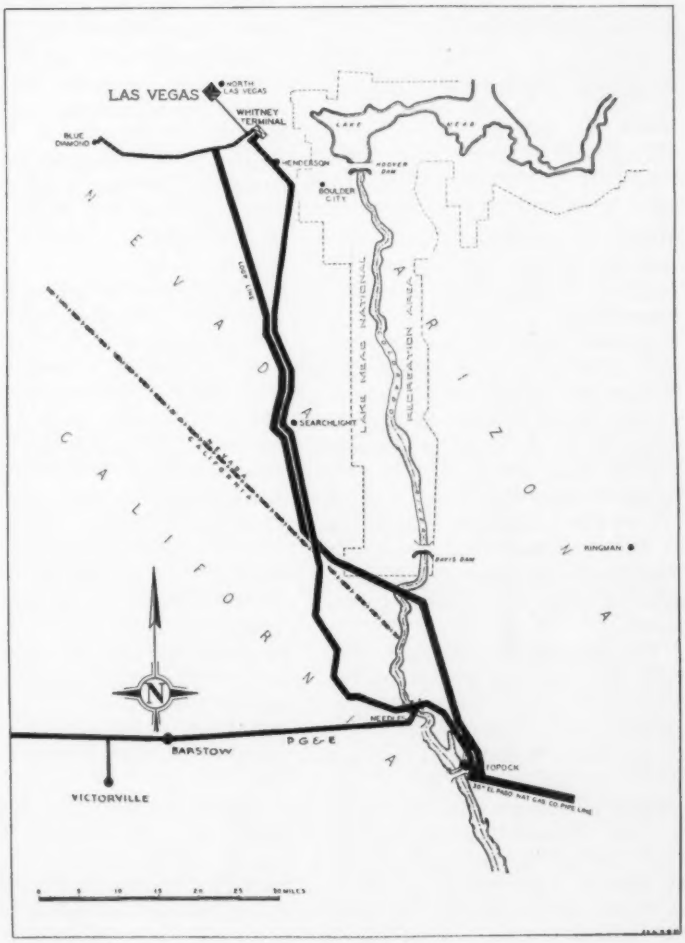
. . . Gas operations in Nevada aided by radio net

By J. FRED EBDON • Editor

A NATURAL gas transmission system will not operate and maintain itself. Men and equipment control gas flow, construct new facilities, and maintain the physical plant. When several distribution systems are tied-in to a pipeline at relatively separated points, the control of gas, men and equipment becomes more complex in direct relation.

Key to operating a transmission system, and associated distribution networks, is efficient communications. Men and tools have to be in the right place at the right time for all phases of system operations. Supervision and dispatching must accompany operational activity. The interchange of information among personnel, departments, and control points necessitates fast, flexible, dependable communications. Many gas companies are making good use of radio for producing these base factors in a communications system.

Nevada Natural Gas Pipe Line Co., with headquarters in Las Vegas, Nevada, and its affiliated



Nevada Natural's pipeline route.

Remote relay station in rugged El Dorado pass. Natural gas engine-driven generators provide all power requirements.

distribution company, Southwest Gas Co. in Los Vegas and California's Mojave desert country, comprise gas systems that are realizing and extending advantageous use of radio communications. Although the communications are not as yet complete, with the present wind-up of projects recently started, these companies will have complete communications systems for the supervision and dispatching of men and machines throughout their combined construction, transmission, and distribution operations.

The transmission company, Nevada Natural Gas Pipe Line Co. owns and operates two essentialiy parallel lines from Topock (in northwestern Arizona) to the outskirts of Las Vegas. All of the company's customers are located in the Las Vegas-Henderson area of Clark county, in the southern tip of Nevada. Country traversed by the route of the original 10.75-in. OD transmission line and the paralleling combination 12- and 16-in. pipeline is rugged, isolated, and widely unpopulated. It is desert and rolling plains with three mountain ranges, each over 6000 ft, to complicate the otherwise easy terrain. Roads are scarce, and public communications systems are limited or non-existent.

El Paso (Texas) Natural Gas Co. is the single source of supply for Nevada Natural. Gas is metered to the latter at Topock, Ariz. Much of this gas is transmitted to a terminal master metering station at Whitney, Nev., just outside of growing, prosperous Las Vegas. However, even more gas is sold to industrial consumers in Clark County.

At Whitney station, gas is sold to Southwest Gas Corp. for distribution to consumers in Las Vegas and other nearby communities. This is a rapidly expanding service territory. Other distribution customers are the California - Pacific Utilities Co., Henderson and Citizens Natural Gas Co. Boulder City.

Southwest Gas also operates distribution properties in Barstow and Victorville, Calif. and serves numerous small communities throughout the Mojave desert. Gas supply for the Southwest Gas system in California is from PG & E's Super Inch line. Control and operation in the fast growing, combined systems of the different areas posed a problem. Use of two-way radio was obviously the solution.

Early in 1955 a simple system, made up of a VHF base station and six mobile units, was placed in operation. Within a few months, nine additional mobile units and another base station—this one located in the company's downtown offices — were added. This basic service included both Motorola and General Electric equipment. It proved that such a widespread operation needed the most modern, and carefully engineered communications net to properly support the continued expansion of the gas transmission and distribution properties.

Near the end of 1955, the paralleling 12- and 16-incher was designed and certificated. It became necessary to expand the communications net so that mobile units on the construction project could be efficiently supervised and controlled from headquarters in Las Vegas.

Studies of the systems required and available equipment were begun. By Jan. 31, 1956, a decision had been reached to provide communications between the Las Vegas dispatcher and the El Paso Natural Gas dispatcher at Topock. This would permit immediate and vital control of men and equipment working on the line, particularly when loading tests were being made, and proper manipulation of valves during purging operations. Also, two line breaks pointed up the absolute necessity of instant and complete communicative control throughout the entire gas system.

At this time, all of radio maintenance and installation was performed under various contracts. The company was at the mercy of the contractors when emergency repairs were needed.

As a result of the studies, it was decided to retain H. E. Samuels Inc., Carson City, Nev., as communications consultant to engineer and supervise the design-installation phase of the newly planned network. Herbert E. Samuels, president of the corporation, had just completed design and partial installation of a state-wide system providing car - to - car and car - to-base, as well as point-to-point, communications for the Nevada Highway Department.

Under Samuels' guidance, the company hired its first radio technician and contracts for maintenance and service of mobile and station gear were cancelled. Since then, communications operations proceeded at flank speed.

First step in re-design was to eliminate the second base station (in the downtown office), and, with the use of leased telephone wires, a remote control unit was set up in its place. This also offered an inter-com system between the dispatcher at the plant and the clerk handling customer service in the "front" office.

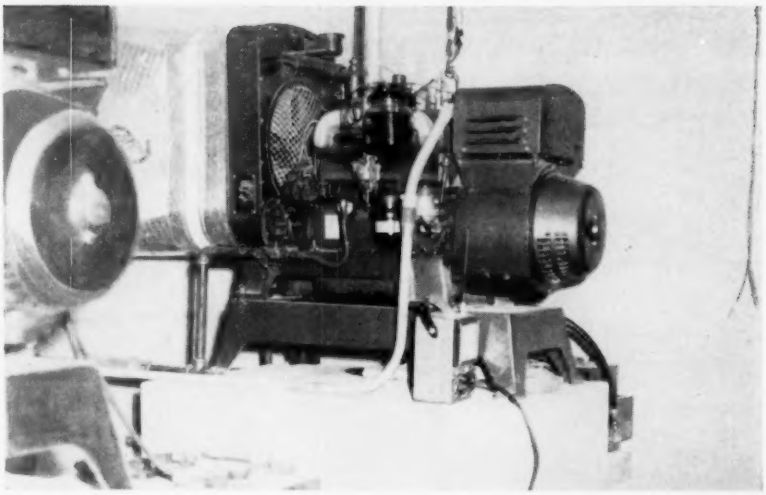
Biggest problem confronting the communications engineer was how to provide the direct conversational contact with the El Paso metering station at Topock Ariz. from Las Vegas. Topock lies some 90 odd airline miles south of Las Vegas, and is separated by three mountain

ranges. Elevations from 1000 to 6000 ft above sea level are involved. Las Vegas base station sits on a sort of bench at less than 2000 ft elevation, while Topock rests on the SE shore of the Colorado at little more than 400 ft.

The answer seemed simple, at first glance: use relay stations to control a radio-controlled base. With this in mind, surveys were conducted using mobile equipment in the allowable frequency range. The first obstacle then turned up. Terrain conditions dictated that the radio-controlled base station be placed somewhere near Searchlight, Nev., approximately half-way between the ends of the pipeline, and (fortunately), in an area that boasted "hill-top antenna sites."

The hard - to - overcome obstacle was the fact that Las Vegas area was classed as a "channel" region, thus eliminating the use of frequencies in the 72-76-mc band for relay purposes. Next desired and available frequencies were in the 150-mc band. Survey indicated that a high-powered 150-mc transmitter, aided and assisted by highgain corner reflectors, could satisfactorily be used for relay link between Las Vegas and Searchlight, nearly 50 miles away. This line-of-sight path was interrupted by a slight bend at El Dorado Pass, about 19 miles out of Las Vegas. With these data in hand, search was made for available frequencies. Reply from the Region VII coordinating committee for the Petroleum Frequency group, indicated that there were no frequencies available. This meant the next highest band, the 450-mc group would have to be employed. And, this also meant an additional relay station would have to be added to the system at El Dorado Pass (because of the bend), where there was neither power nor reasonable distance to commercial power.

Since the new line passed within 1500 ft of a suitable location, the company decided to generate its own power. With the help of Compton Electrical Engineering Co., a plant was designed utilizing natural gas for fuel. Two Kohler combustion type engines power a pair of 5-kw generators. An automatic control panel alternately switches the power units every 24 hours. The resting engine stands by and will cut in in case of a failure or drop in voltage from the operating unit. One-inch steel pipe acts as engine-fuel line from the pipeline and as conductor for cathodic protection current applied from the gas-driven generator.



Twin gas-engine generator sets furnish power for El Dorado relay station in hot, dry, isolated Nevada desert country.

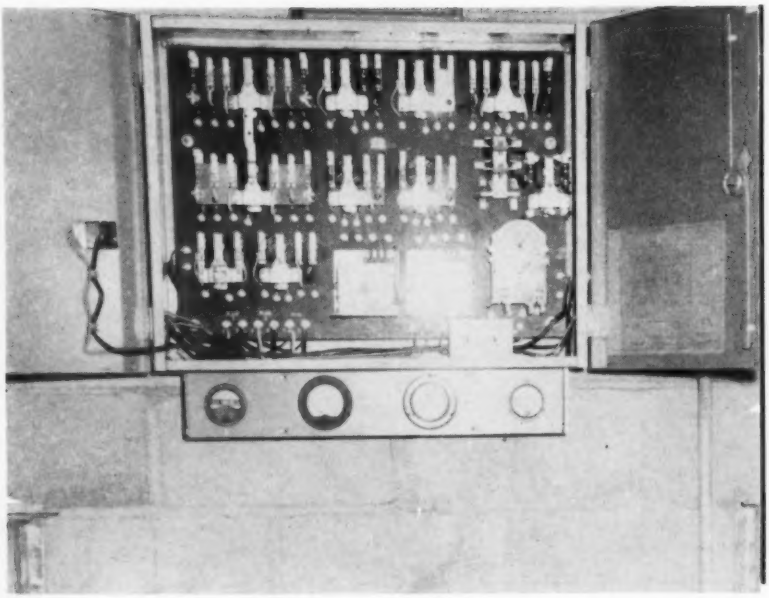
Equipmentwise, the system is composed of a 60-w, G. E. SC-26 base station located at the Las Vegas plant and remotely controlled from the downtown office. A 15-w, 450-mc control station (RCA CSU-15), also located at the plant and remotely controlled, provides the first link in the relay chain. An Andrews 3606-2 corner reflector points the 450-mc signal directly towards El Dorado where it is received on a high gain omnidirectional (Andrews 4002). At El Dorado, an RCA CSU-15, with carrier-operated relay for automatic re-transmission, provides the necessary transmitting and receiving gear. The signal is released on another 450-mc frequency and is received on a corner reflector and an RCA CSU-15 at Searchlight. The 450-mc receiver triggers an RCA CSF-60; which, coupled to a CESO, radiates the mobile frequency with the greatest gain along the right-of-way paralleling the highway.

At Topock, a 60-w base station (RCA CSF-60) is remotely controlled from the dispatch point, located just more than a mile away from the antenna site. A CECO, mounted on top of an 80-ft water tower, gives a perfect radiation pattern for the pipeline operation.

The complete system provides for car-to-car audio at any point where mobile communications are possible, base-to-mobile throughout the entire area of operation, and mobile-to-El Paso dispatcher in the Topock area.

These facilities were installed and placed into functional operation during the summer of 1956. Results have been excellent. The Nevada Natural group has good communications for routine operations; and fast, dependable communications for the inevitable, but fortunately few, times when emergency situations are encountered. Radio communications at times of emergency are particularly valuable, because the country is desolate, and men and equipment are put to extreme punishment when working under pressure to restore service. Too, weather conditions are frequently at extremes. Summer temperatures are in the 100's, and winter cools are near to below freezing. Safe handling of life and property has been made possible by use of mobile communications.

While this initial communications system was being designed and installed, it became evident that radio would be required in the Southwest Gas operations at Barstow and Victorville. Again, the problem was one of supervising and controlling crews and machines operating in the remote Mojave



Generator set control panel in El Dorado station. Power units are automatically switched every 24 hr. The quiet engine is on standby and is automatically started if operating engine cuts out or drops voltage.

desert country, far from existing means of communications — or much of anything else.

VHF base stations were installed in both Barstow and Victorville for local area coverage. This limited service worked out for a short time. Vehicles operating close to home could easily be contacted for routine customer service. However, distribution service in the desert area is expanding fast. Distribution operations were planned and installed in Lucerne and Apple valleys, near Victorville, at Dagget and Yermo, near Barstow, and in numerous other small (but well populated) areas in the region. Each of these areas was generally out of range of either of the local base stations.

To obtain complete coverage of the desert area, it was obvious that use of relay stations would be necessary. Several possibilities presented themselves: locate a radio controlled base on a hill-top near Barstow for broader coverage in that area, locate another in the vicinity of Victorville for help in that area. Surveys were made and the results tabulated.

At least five mountain tops in the region would give ample coverage for the two stations. But, negatively, the answers were: (1) lack of commercial power, and (2) in some cases, poor winter or summer accessibility. Also, two or more stations added up to quite a bit of investment.

Continued search and study revealed an 8300-ft peak in the San Gabriel mountain range, nearly 40 air-miles west of the service area. This one spot provided solid signal paths to all of the fringe area of the two districts — Barstow and Victorville. And, most important, this peak also offered a clean line of sight to the two control points. This single spot offered a radio-controlled base station location to handle two jobs and a site that would permit the use of 450-mc band for control purposes. To further clinch this choice, commercial power was available at the antenna site, and summer or winter access was easy. The location? At the top of Holiday Hill ski lift. Rental arrangements included necessary space and use of the chair lift when winter snows cover the mountain.

Maintenance of a system as complex and widespread as that of the Nevada Natural and its affiliates, poses a problem of another sort. First, time is of importance. Second, outages must be held to a minimum, or, if possible eliminated. And, due to the size and scope of the plant, men and tools have to be moved great distances on short notice.

A company-employed technician, Virgil McDonald, maintains the communications operations from his Las Vegas headquarters. "Mac" installed all of the relay gear, and most of the mobiles. Therefore, he knows the equipment and its functions from the chassis to the antenna. To equip himself for his job, Mac has built his own bench, at Las Vegas, complete with cabling and connections for each type of unit he has in the system. Also, he has most of the usual types of test gear, including a Measurements 80R, Lampkin 105-B and 205-A frequency and modulation monitors, VTVM and ohm-meters, and test meters for each type of mobile.

An adequate stock of replacement parts makes his repair time short and comparatively inexpensive.

Out on the line, Mac uses a panel truck. It is completely equipped with a library of instruction books for each piece of equipment, spare parts, meters, tools, etc.

When at home, Mac begins his day by getting to the plant at least a half-hour ahead of the time the men depart on their assignments. He checks with the dispatcher for "trouble" reports, and, in most cases, is able to bring defective mobile units into operation within a few minutes. If he sees that he has a rig that will require considerable time, he replaces it with a spare rather than tie up a man and vehicle. As soon as the mobiles are on their way, he checks his system, and if necessary warms up his truck for a two or three hour drive to a relay or base station.

Should a mobile be reported having trouble while on the job, and is within a reasonable distance of the plant, Mac drives to the truck or pick-up and repairs, or replaces the unit while the crew continues its work.

Although figures are not complete for the first year's operation, it is anticipated that system costs will run in the neighborhood of $18 to $20 per month per mobile, including depreciation. ■

Internal surface coating of pipe

By G. G. WILSON and R. T. ELLINGTON
Institute of Gas Technology, Chicago

EXTENSIVE efforts have been made for many years to prevent corrosion of the outer surface of buried pipelines, and recently the problem of mitigating internal corrosion has become important to pipeline operators. The major portion of pipeline dust is iron oxide, formed by corrosion of the pipe surface. This dust can damage pipe fittings and regulator valves by abrasion, contribute to inaccurate orifice metering by adhering to or eroding the edge of orifice plates and cause faulty operation of appliances through stoppage of orifices or house piping. The flow efficiency of some pipelines has decreased in service and detergent cleaning or pigging has been necessary to remove corrosion products from the line. Internal corrosion has also contributed to the failure of pipelines carrying sour gas or crude oil.

Early studies of the internal corrosion of gas pipelines indicated that the presence of water is essential to the corrosion process and that corrosion is promoted by the presence of H_2S, O_2, and CO_2. Appreciable internal corrosion has occurred in stored pipe subject to atmospheric conditions and occurs more rapidly in industrial atmospheres or near bodies of salt water.

The dehydration and desulfurization of natural gas at processing plants prior to its transmission have proved effective in eliminating internal corrosion and in maintaining the flow efficiency of gas transmission pipelines. However, other measures must be taken to prevent the corrosion of pipe in storage or in gas gathering lines. One method of preventing interior corrosion of pipe is to coat the inside surface of the pipe with a corrosion resistant material. To evaluate the feasibility of internally coating pipe for gas service, a survey of the literature and industry practice on this subject was initiated at the Institute of Gas Technology in 1955 as Project NB-14, "Internal Coating of Pipe" sponsored by the pipeline research committee of the American Gas Association. This project was extended through 1956 to include the laboratory measurement of pertinent physical and chemical properties of the types of coating materials selected as most promising for gas pipeline service through the previous year's work. A survey was also conducted of methods used by the industry to prevent corrosion of pipe in storage. The laboratory evaluation work was extended through 1957 to permit longer exposure periods for the chemical immersion and atmospheric exposure tests.

The survey of the literature and industry practice was made to determine the present state of the art of internally coating pipe, and ascertain which types of plastic coating materials could be expected to withstand gas pipeline service conditions. This survey included published literature and consultation with users of internally coated pipe, and coating manufacturers.

Industrial experience: The first use of pipe coated internally with plastic occurred in 1943 when a baked-on phenolic coating material was used successfully to coat well tubing for use with sour crude oil. A total of 2 million ft of tubing coated with this type of material is estimated to have been installed in condensate and sour crude oil wells from 1945 through 1948. Although some failures occurred within six months to two years, satisfactory results have been reported for eight to nine years' service.[1] Most failures were attributed to faulty surface preparation or defective pipe. This type of coating material is considered adequate for this service except for a tendency to chip under the impact of tools and a susceptibility to erosion failure in wells producing at a high rate.

Corrosion of sour crude lines was particularly serious in west Texas, and a method of internally coating pipelines in place was developed by Curtis and Tomlinson.[6] Since 1948, this process has been used to coat many miles of oil field flow lines in the Permian basin. Until recently the material most commonly used was based on resins comprised of vinyl chloride-vinyl acetate copolymers. A number of cases have been reported where crude oil pipelines with extensive leakage histories suffered no further failures in two to six years of service after coating. Since 1954, coating materials based on epoxy resins have largely replaced the vinyls for this service because of their excellent adhesion, serviceability at temperatures up to 250°F, and relative ease of application to pipe in place. Detailed

information on oil field service experience with internal coatings has been given in reports of the biennial tours sponsored by the Permian Basin section of the National Association of Corrosion Engineers and in a paper by Watts.[6]

Use of internally coated pipe for natural gas service began in 1954 when 42 miles of 16-, 20-, and 26-in. pipe were laid by The Manufacturers Light & Heat Co.[3] and coating of 200 miles of 30- and 36-in. line was started for the Transcontinental Gas Pipeline Corp. An amine-cured epoxy applied to a thickness of 1-2 mils in one coat was used on most of this pipe, although a modified vinyl applied to a thickness of 0.5 to 1.25 mils was used on some of the pipe coated in 1954. The major benefit anticipated was prevention of internal corrosion during storage and hydrostatic testing. Manufacturers Light & Heat is particularly interested in reducing foreign matter entrained in the gas, and is conducting tests to determine the effect of the coating on the quantity and composition of the foreign matter in the lines. Several short sections of the coated line have been cut out after approximately 1.5 years of service, and the coating found intact. The coating opposite welds was totally destroyed for a distance of 0.5-1 in. each side of the weld, and zones of charred coating extended for an additional 0.5-1 in.[3]

The benefits anticipated by Transco included the reduction of post-construction cleaning costs and preservation of a smooth pipe surface. Transco has also found that inspection of pipe internally coated at the mill is much easier due to improved reflection of light. Transco's initial experience with internal coating of pipe has been such that it has continued to coat most of its new pipe.[5]

Methods of applying coatings: Foreign material such as dust, mill scale or oil tends to interfere with the wetting of metal by a coating material, and will have detrimental effects on the durability of the coating.[4] Consequently, proper surface preparation is an important consideration in any coating operation. The extent to which surface contaminants must be removed to obtain satisfactory coating performance will depend on the wettability of the coating material.

Wire-brushing and chemical methods have been used to clean the interior of large pipe. Shot- and grit-blasting have been used extensively to clean small-diameter drill

(*Continued on page* 112)

Table 1—LIST OF COATING SYSTEMS INCLUDED IN THE TEST PROGRAM

Code No.	Principal Resin Ingredients	Curing Agent	Principal Pigments	Wt % Pigment	Wt % Total Solids
E-1-D	Epoxy	Diethylene Triamine	Magnesium Silicate, Rutile TiO_2	39	65
E-1-I	Epoxy	Isopropylamino Propylamine	Magnesium Silicate, Rutile TiO_2	39	65
E-2-D	Epoxy	Diethylene Triamine	Red Lead, Silicates	65	80.5
E-2-I	Epoxy	Isopropylamino Propylamine	Red Lead, Silicates	65	80.5
E-3	Epoxy and Modified PF[1]	Heat—350°F	Chrome Oxide Green	9.2	40
E-4	Epoxy	Polyamide Resin	Magnesium Silicate, Rutile TiO_2	39	65
E-5	Epoxy	Polyamide Resin	Red Lead, Silicates	65	80.5
E-6	Coal Tar and Epoxy	Organic Amine	Mineral Filler and Ash	22	72
E-7	Epoxy	Diethylene Triamine	Chrom. Oxide	31	70
E-7 Primer	Epoxy	Diethylene Triamine	Iron Oxide, Chromates	35	55
E-8	Epoxy	Diethylene Triamine	Magnesium Silicate, Iron Oxide	15.2	58.2
E-9	Epoxy	Polyamide Resin	Iron Oxide, Siliceous Extenders	41.5	69.3
E-10	Epoxy Fatty Acid Ester	Air Dry—6 hr	Iron Oxide, Zinc Chromate	20.0	39
E-11	Epoxy	Polyamide Resin	Lamp Black	8.4	51.8
E-11 Primer	Epoxy and Alkyd	Polyamide Resin	Zinc Chromate, Mica	41.0	55.3
E-12	Epoxy	Diethylene Triamine	Magnesium Silicate, Rutile TiO_2	39	65
E-12 Primer	Epoxy	Diethylene Triamine	Red Lead, Silicates	65	80.5
F-1	Furfuryl Alcohol	Sulfuric Acid	None	None	Approx. 100
F-1-B Primer[2]					
F-1-W Primer[2]	Polyvinyl Butyral				
F-2	FA—Epoxy[4]	Heat—330–500°F	None	None	Approx. 100
N-1	Neoprene Type KNR	Lead Oxide Compound	Carbon Black	19	56
N-1 Primer	Phenolic Nitrile	Air Dry	Iron Oxide, Red Lead	23	36
N-2	Neoprene Type KNR and Phenolic	Air Dry—4 hr	Carbon Black	14	34
N-2 Primer	Phenolic Nitrile	Air Dry	Iron Oxide, Red Lead	23	36
P-1	PF[1]	Heat—350°F	None	None	Approx. 100
P-2	PF and Polyamide	Heat—400°F	None	None	80
P-3	PF and PVA[5]	Air Dry—5 min	Iron Oxide, Zinc Tetroxy Chromate	10.0	39
Po[6]	Polyester and Isocyanate	Air Dry—10–15 hr	TiO_2	30.8	72.0
			None	None	45.0
Po Primer[3]	Polyvinyl Butyral	Air Dry—24 hr	Zinc Chromate	10.9	19.7
U	Alkyd and UF[7]	Phosphoric Acid	Iron Oxide, Red Lead, Extender	40.4	65.2
V-1	Copolymer VC[8] and VA[9]	Air Dry—1–2 hr	Anatase TiO_2	15.0	31.0
V-2	PVC[10]	Air Dry—1–2 hr	Red Lead	25.0	40.0
V-2 Primer[3]	Vinyl Butyral	Air Dry—24 hr	Basic Zinc Chromate	8.0	15.2
V-3	PVC, Liquid Epoxy, and UF	Heat—300°F	Anatase TiO_2	8.3	35.0
V-4	Natural, PF, and PVA	Air Dry—½–1 hr	Aluminum	52	Approx. 100
V-5	Copolymer VC and VA	Air Dry—1 hr	Blue Lead, Mica, Rutile TiO_2	25.4	49.4
V-5 Primer	Copolymer VC and VA	Air Dry—1 hr	Red Lead, Mica, Rutile TiO_2	23.2	40.0

[1] Phenol-formaldehyde
[2] Commercial primer identified only by trade name
[3] Commonly called a wash primer
[4] Furfuryl alcohol copolymerized with epoxy resin
[5] Polyvinyl acetate
[6] Commonly described as a polyurethane coating
[7] Urea formaldehyde
[8] Vinyl chloride
[9] Vinyl acetate
[10] Polyvinyl chloride

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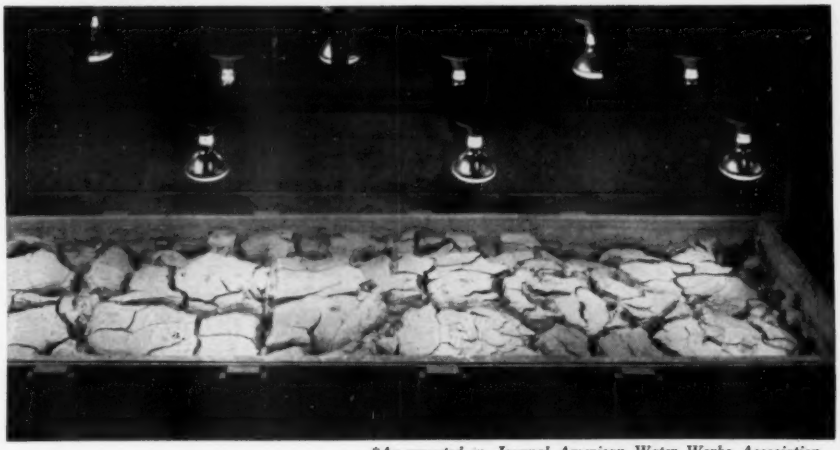

*As reported in Journal American Water Works Association, Vol. 48, Feb., 1956. Photo courtesy U.S. Bureau Of Reclamation.

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It was conclusively demonstrated that glass fiber mat like Blue Flag, with coal-tar enamel, provides effective protection against *both* soil-stress and backfill-puncture action. (See picture caption above for actual test conditions.)

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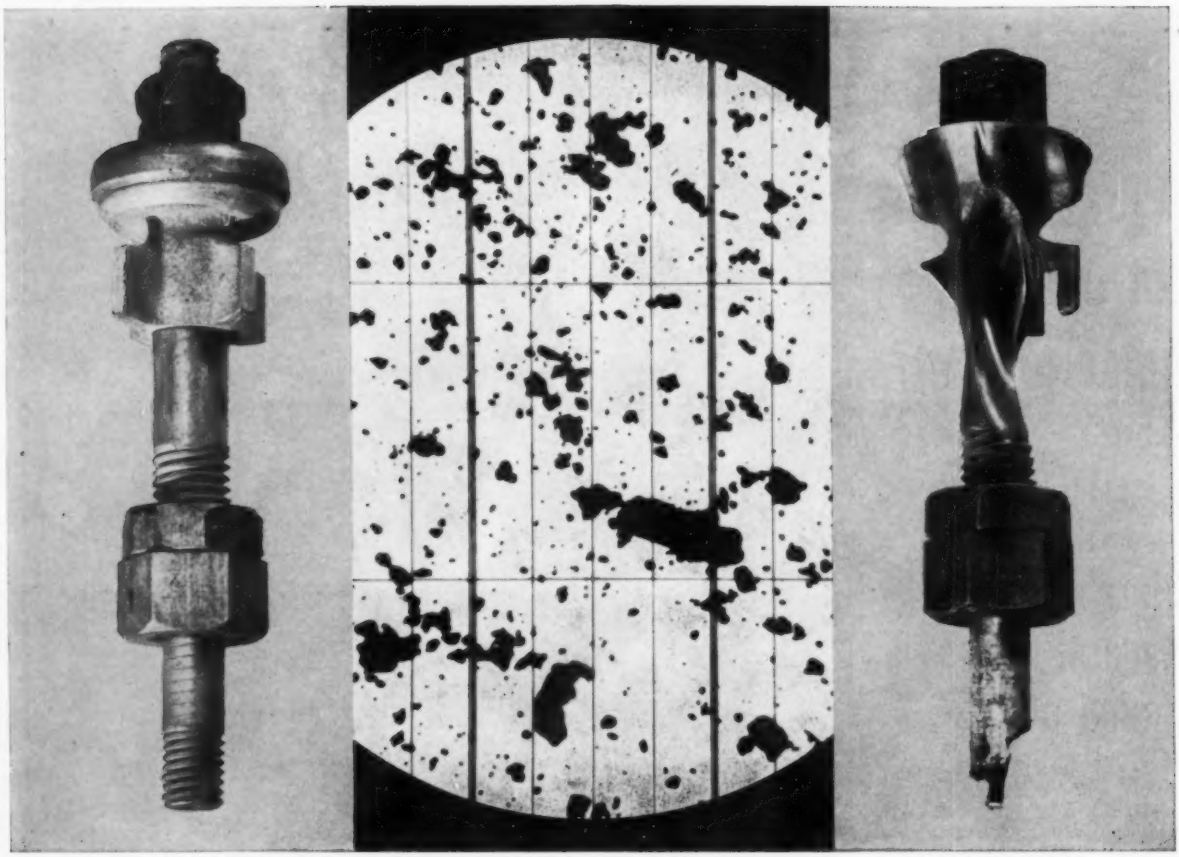

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designed to control gas pressure with accuracy and dependability

handling gas
with invisible dust that's revealed only by 40 power magnification

blasted by dust
making the regulator inoperative, cutting off the town's gas supply

Blaw-Knox Gas Cleaners end all dust damage

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Fig. 1. Gas blistering of neoprene coating material.

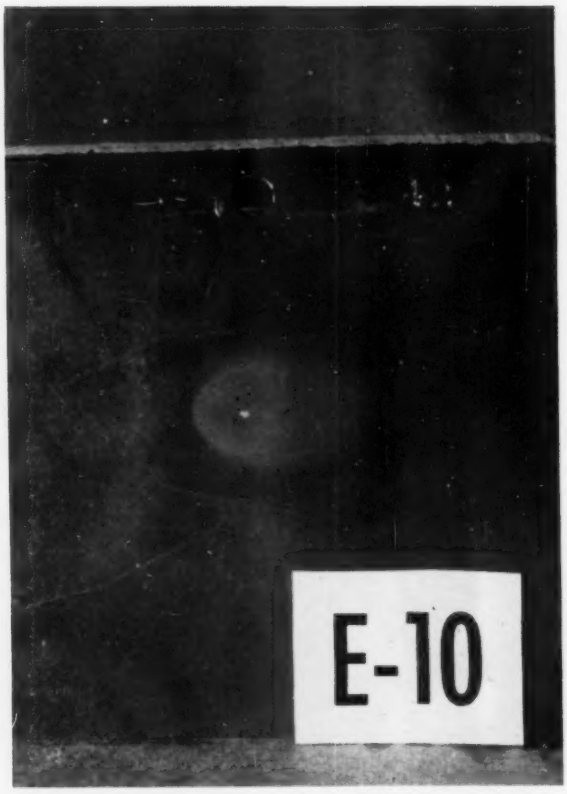

Fig. 2. Wear pattern produced by air blast abrasion test.

(*Continued from page* 108)

pipe. Until recently the cost of grit-blasting has obviated its use for large diameter pipe, but recent developments have reduced costs and made it more competitive with chemical cleaning methods.[5]

A machine has been developed that can be used to clean and coat the interior of pipe in one operation. It consists of a boom-mounted cleaning and coating head with a number of wire brushes around its circumference, paint spray nozzles attached in front of the brushes and compressed air nozzles behind. The cleaning head is forced through the pipe while being rotated and compressed air is forced through the air nozzles to blow scrapings out of the pipe. Plastic coating material is then spray-applied as the head is withdrawn from the pipe section on the final pass. This machine has been found to be particularly suitable for coating at pipe mills where the method of pipe fabrication loosens the mill scale.

Chemical cleaning methods have been found most effective for the preparation of pipe with tightly adhering mill scale or whose surface is contaminated with oil, grease, or chalk. A procedure of this type was used for the surface preparation of some of the first large-diameter pipe internally coated for Transco,[5] and consisted of: a) alkali wash; b) water rinse; c) pickling; d) water rinse; and e) immersion in a phosphatizing solution. After this treatment, coating was applied by a spray-coating head drawn through each pipe section. Portable equipment has been developed for this chemical cleaning and coating operation.[5]

Chemical cleaning methods are the only ones satisfactorily developed for the in-place coating of pipe. The method most widely used utilizes specially designed plugs, or swabs, propelled by air pressure to carry cleaning solution and coating material through the pipe.

The in-place coating of a pipeline will usually involve the following steps:

1. Any oil or gas in the lines is displaced with water, or small batches of solvent, followed by small batches of alkaline detergent solution, with swabs separating the individual batches.
2. Conventional pigs are usually run for a preliminary cleaning operation.
3. Batches of alkaline degreasing solution, containing steel lathe cuttings to provide scouring action, are run through the line between two plugs.
4. The line is washed with water retained between two plugs.
5. A batch of acid cleaner containing a mixture of acids, including inhibited hydrochloric and phosphoric, is run through the line with plugs to provide a clean etched surface.
6. The line is rinsed with water containing a corrosion inhibitor.
7. The line is washed with a drying agent, such as methyl ethyl ketone, and air is blown through the line until it is dry.
8. A primer coat is applied by slugs of coating material carried through the line between two counterfacing rubber plugs against a constant back pressure.

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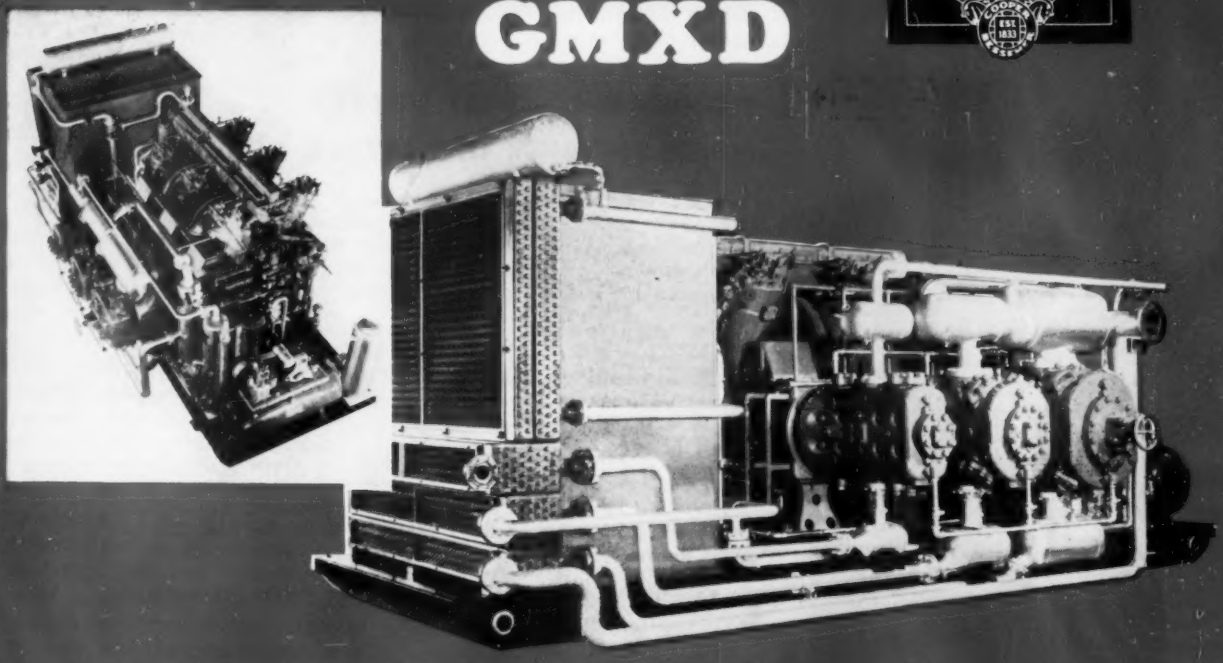

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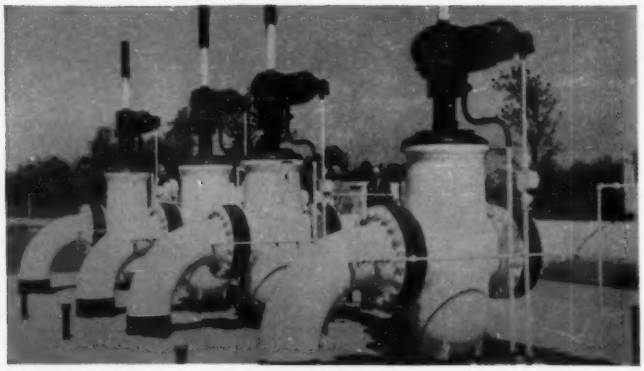
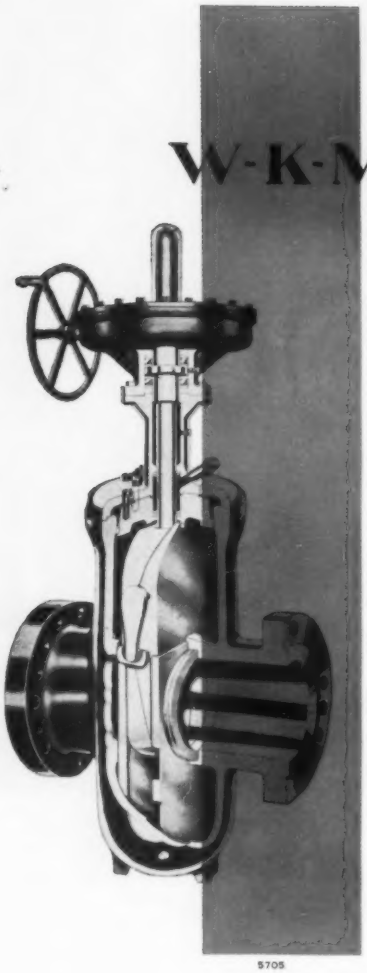


W-K-M *Valves on gas line manifold.*

W-K-M THROUGH CONDUIT VALVES MEAN PIPELINE OPERATING ECONOMY



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The through-conduit of W-K-M Valves means "expressway" flow on the pipeline. There's no turbulence—no more pressure loss through a full-opening W-K-M Valve than through the same length, same size pipe—no additional power required to move gas or liquid through the line—that's economy!

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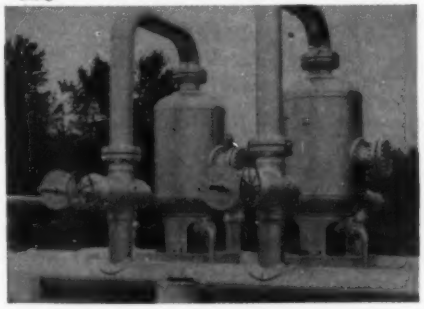

W-K-M *Valves on inlet scrubbers on main line compressor station.*

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9. Excess primer is removed at the downstream end, and the prime coat is dried by aspirating air through the pipe.

10. Two or more finish coats are applied in the same manner as the prime coat.

Materials recommended for interior coatings: As part of the initial Project NB-14 survey, over 30 manufacturers and formulators of coating materials were asked to submit data on the physical and chemical properties of materials considered most suitable for service as an interior gas pipeline coating. Pertinent information on these materials also was obtained from the literature. Users of internally coated pipe were solicited for information on the serviceability of the materials employed. The epoxys, vinyls, furans, phenolics, and neoprene, were judged the families of resins showing most promise, in approximately the order of their listing. Many different types of coating formulations, with a considerable range of properties, can be produced within each of these families except neoprene. Over 40 proprietary coating formulations based on resins belonging to these families were recommended as suitable for gas pipeline service by coating manufacturers. Although manufacturers were most cooperative, the information furnished on the pertinent physical and chemical properties of their formulations was incomplete, or on different and qualitative bases, which made comparison difficult.

Since it was not possible on the basis of available information to determine which types of formulations utilizing these more promising resins would be most satisfactory for interior pipe coatings, a program of laboratory testing was recommended to further screen the promising materials.

Laboratory evaluation

Project NB-14 was extended through 1956 to include laboratory measurement of the pertinent properties of the types of coating formulations selected as most promising for service as internal gas pipeline coatings.

Desirable properties: Consideration of the service conditions to which an internally coated natural gas pipeline might be subjected led to the conclusion that the physical properties of primary importance included: adhesion, flexibility, impact resistance, abrasion resistance, ability to withstand cyclic pressuring and depressuring with natural gas at pressures up to 1000 psig without blistering or flaking, and the ability to break down or decompose without forming large flakes or chips when subjected to the temperatures encountered during welding operations. Accordingly, simple laboratory methods of evaluating these physical properties were selected from methods devised by the coating industry, or were developed at the institute. Wherever possible an ASTM Standard test method was employed.

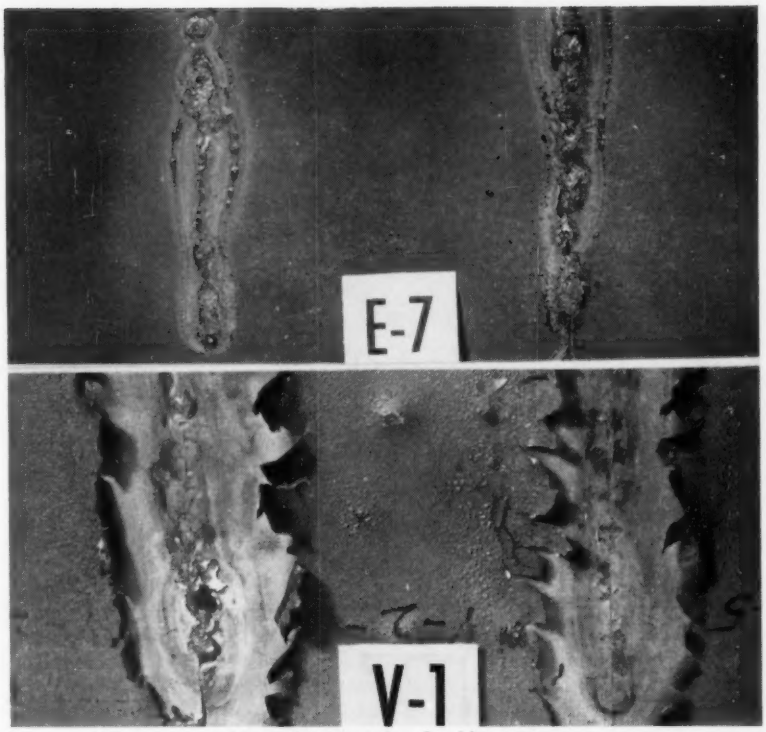

Fig. 3. Typical results of welding test.

Materials used to coat the interior of a pipeline may be subjected to any or all of the following environments:

a. Atmospheric conditions in a pipe storage yard with exposure to air, water, and possibly such agents as H_2S and SO_2 in industrial atmospheres, or salt spray at locations near bodies of salt water.

b. Reservoir fluids encountered in gathering systems, especially natural gas hydrocarbons and salt water containing dissolved acid gases such as carbon dioxide and hydrogen sulfide.

c. Purified natural gas contaminated with compressor lubricating oil or carryover of treating agents such as ethanolamine, ethylene glycol, solid desiccants, or light oil.

It was concluded that the ability of various types of coating materials to withstand these chemical environments could be evaluated satisfactorily from atmospheric exposure of some coated test panels in an industrial area of Chicago, and partial immersion of others in the following chemical agents at a temperature of approximately 130°F: lubricating oil; natural gasoline; a representative acid gas removal agent consisting of 75 per cent diethylene glycol, 20 per cent monoethanolamine and 5 per cent water by volume; a saturated solution of sodium chloride; and tap water saturated with H_2S and CO_2, each at a partial pressure of 30 psi, to correspond to a sour gas containing 3 per cent each of hydrogen sulfide and carbon dioxide at a pressure of 1000 lb.

The methods selected for measur-

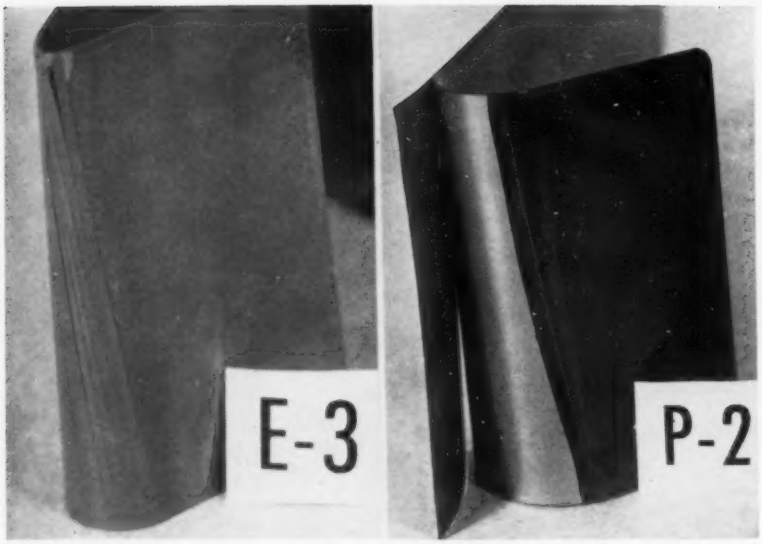

Fig. 4. Typical results of flexibility test.

ing physical and chemical properties required the application of the formulations to be tested to steel test panels. The panels used were obtained from a commercial organization specializing in the surface preparation of metals for coating. The panels were 20-gauge cold-rolled steel with a phosphatized surface obtained by the Bonderite 1000 treatment. This surface should be equivalent to the best obtainable by chemical cleaning of pipe. A few of the coating materials were also applied to 20-gauge cold-rolled steel test panels which were grit-blasted to produce a uniform anchor pattern depth of 1.5 mils. This was done to provide some comparison of the effect of surface preparation methods on coating performance.

Selection of materials for testing: It was obviously impractical to embark on a program of testing all of the commercial materials recommended as promising for use as an internal pipe coating. Therefore, it was decided to limit the test program to formulations which differed significantly in their film forming, curing or pigmentation ingredients. A total of 28 different types of materials were finally selected for testing after correspondence with interested formulators. These are described in *Table 1.*

Physical test methods: To determine coating *hardness* and *adhesion,* tests were run at 70° and 130°F with a Hoffman scratch tester. This tester utilizes a weight and lever system to load a carboloy scratching tool. As the point is drawn across the test panel it tends to scratch through the film. Hardness is indicated by the force which must be applied to mar the coating surface. Adhesion is determined as the force which must be applied to remove a narrow strip of coating down to bare metal or primer, whichever occurs first. This instrument does not provide a quantitative determination of adhesion, since the results obtained also depend upon hardness, cohesion and plasticity of the material under test. Consequently, the results obtained vary with film thickness. The measured values of adhesion varied from 700 gms to a value greater than the 2450 gm range of the instrument for coating films approximately 1 mil thick.

In the *gas blistering* test, coated panels were placed in a bomb containing nitrogen at 950 psig for one, and again for three, days. At the end of these periods the gas pressure was released suddenly and the coatings examined for any sign of flaking or blistering. Nitrogen was substituted for methane in this test because of the greater convenience in use of an inert gas. This substitution was considered valid because blistering is probably a diffusion phenomena dependent largely on molecular diameter, and the molecular diameter of nitrogen is quite close to that of methane. The results obtained with nitrogen were checked by making one run with methane, which included one panel coated with each material tested, and identical results were obtained. A substantial amount of blistering was obtained with only four of the materials, one of which is shown in *Fig. 1,* included in the tests. The degree of blistering was evaluated by means of ASTM procedure D 714-54T, which is based on comparison of the blisters with a set of pictures showing various sizes and frequencies of blisters.

Abrasion resistance was measured with an air-blast abrasion tester, according to ASTM procedure D 658-44. In this test, carefully sized silicon carbide abrasive is projected against the coated panel at a 45° angle by entrainment in an air stream maintained at a constant flow rate, pressure, temperature, and humidity. As soon as the abrasive action of the air-driven carborundum has worn a hole approximately 2 mm in diameter through the coating (*Fig. 2*), the flow of abrasive is shut off and the weight of abrasive required to secure this result is determined. The abrasion resistance is reported as grams of abrasive required to wear through a unit film thickness of the coating. A precision of ±3 per cent was obtained in most of the runs with this instrument. It was found to be impossible to wear through one type of neoprene coating tested, and the values for other materials ranged from 13 to 166 gms of grit per mil.

The *effect of welding* upon the materials tested was determined by coating two 4- x 12-in., 20-gauge test panels on one side and arc welding them together on the reverse side, using a size 31/32-in. steel rod. In general it was found that a band of coating was totally destroyed opposite the weld, and in most cases the coating was damaged around this area. The appearance of the residue in each area and the approximate average width of each was recorded. Two of the extreme results are shown in *Fig. 3,* in which E-7 is an amine-cured epoxy, and V-1 is a vinyl coating material.

The *relative flexibility* of the

(*Continued on page* 121)

got

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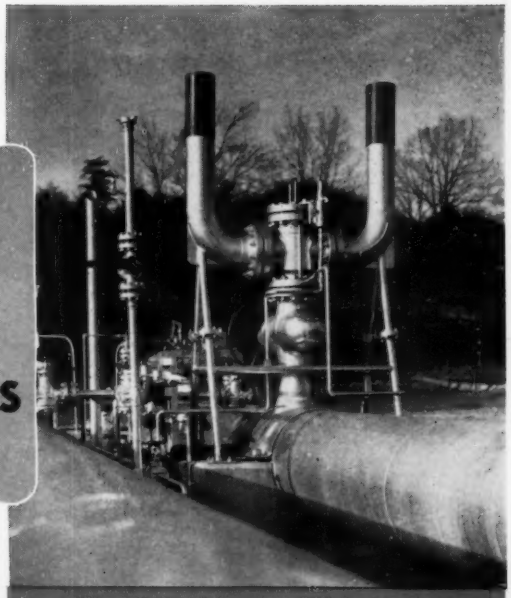

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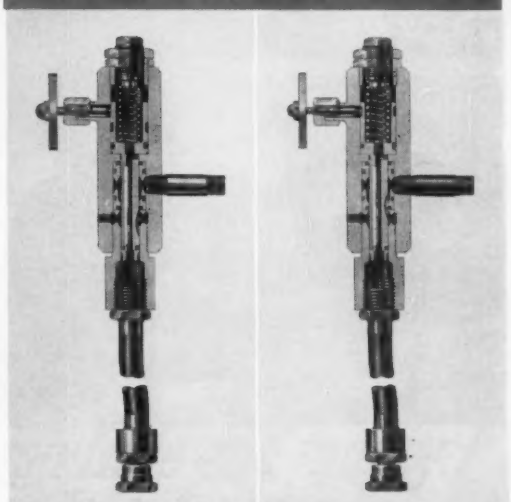

Garrett Type "DO" Operator

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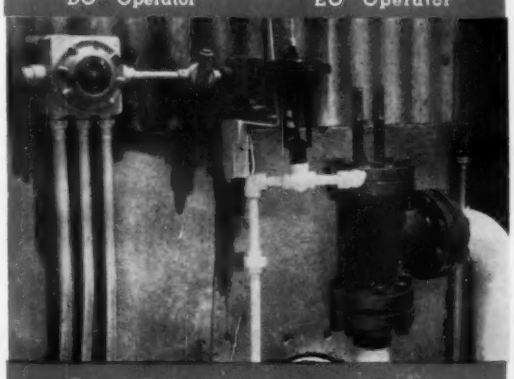

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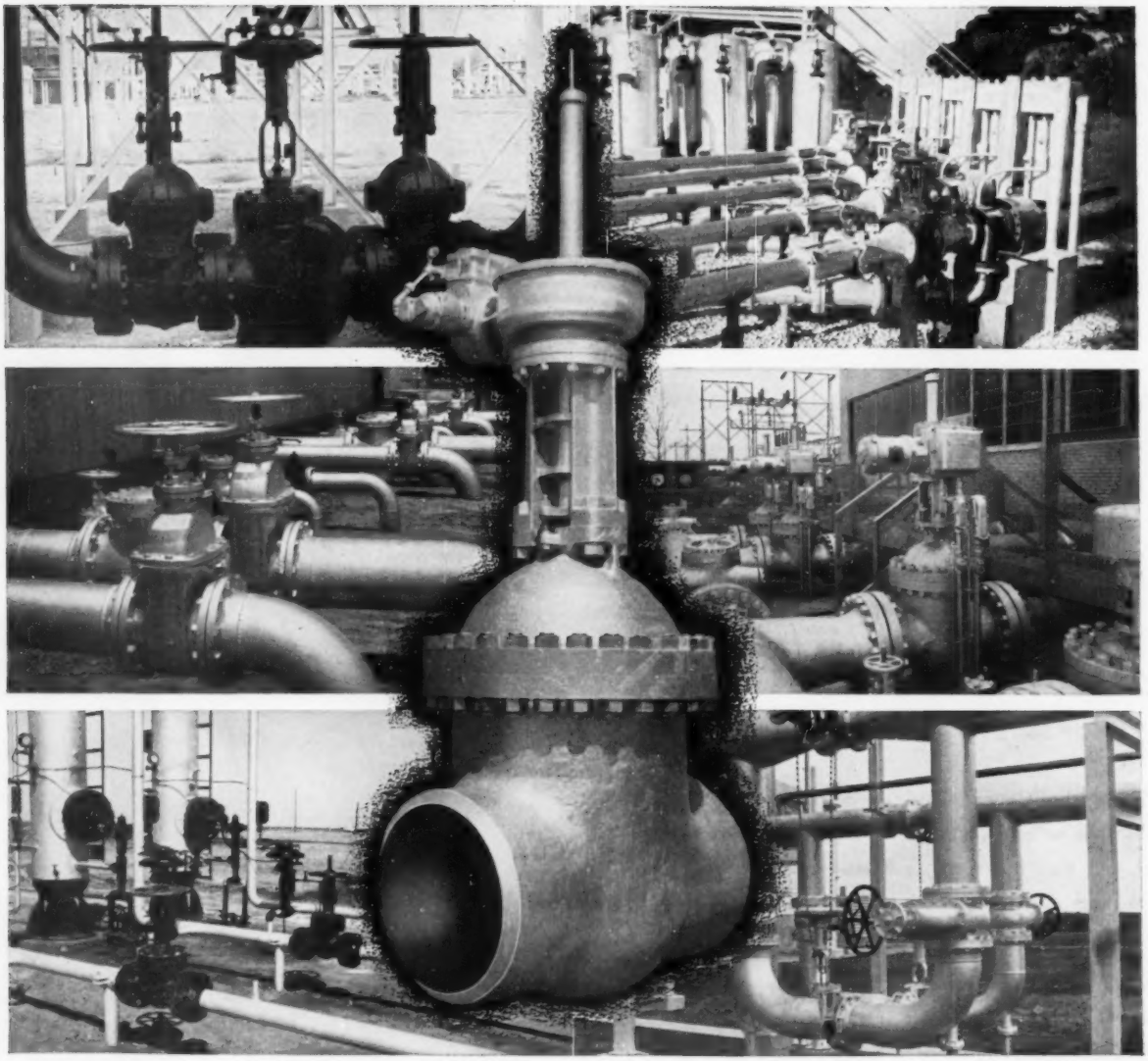

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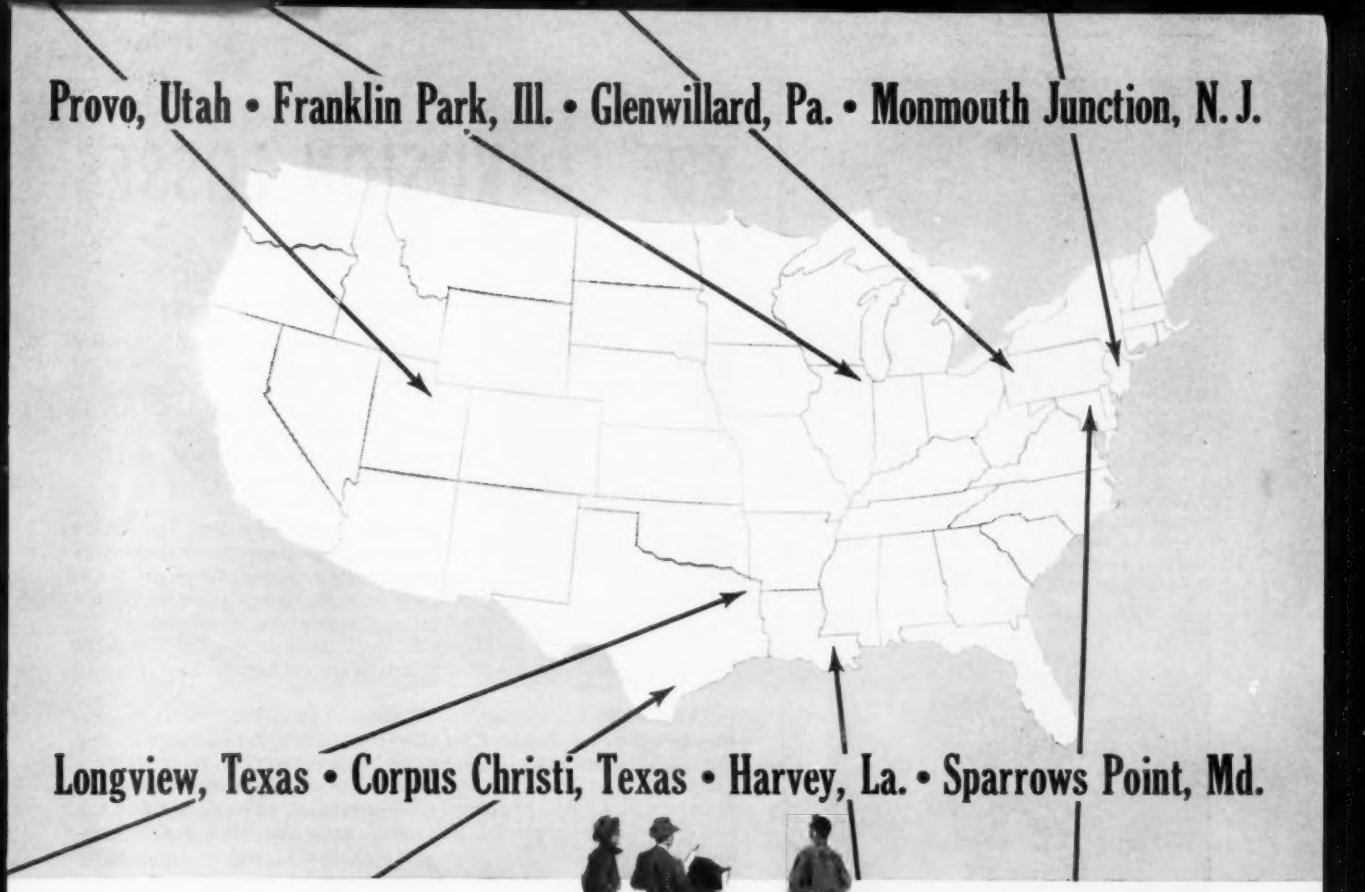

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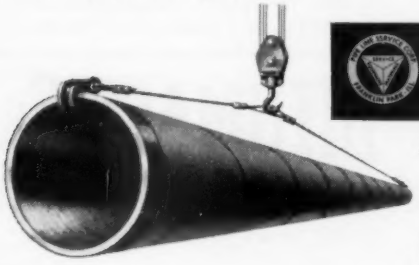

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Since the security of a multi-million dollar investment is at stake, preventing corrosion in buried steel pipelines is extremely important. In this field the decisions made as to corrosion-prevention practice in the *design* phase are irrevocable—and can prove tremendously expensive if wrong.

* * *

Hot applied coal tar enamels have been traditionally the primary part of the protection system on pipelines. In recent years, cathodic protection has become widely accepted as a supplement to coatings.

Enamels must now be judged as much on their value as long-term insulating materials as on their ability to prevent corrosion.

* * *

The best clue to a coating's performance is its ability to resist penetration by water. It is this inherent characteristic that determines a coating material's performance underground, with or without supplementary cathodic protection. As a coating absorbs water, it provides a decreased resistance to the flow of electric current between pipe and soil which is part of the corrosion process. Ultimately, water absorption leads to coating deterioration, which exposes bare pipe. In conjunction with cathodic protection, the coating system's most important function is that of a long-lasting electrical insulator so that impressed current requirements are kept to a minimum. Here too, a coating system's resistance to water penetration determines its performance. Actual pipeline operating experience has shown that the cost differential between maintaining cathodic protection on well and poorly insulated lines can amount to hundreds of thousands of dollars yearly.

* * *

Independent laboratories and industrial researchers have expended considerable time and effort in determining water absorption rates of protective coatings. Long-term tests have demonstrated, without exception, that coal-tar enamels have the highest resistance to water absorption among protective coating materials commercially available today.

The key to a coating's ability to resist water absorption seems to depend on the inherent molecular structure of the base material. The relative performance of a number of coatings in these various tests indicates that coating impermeability depends upon *aromatic content.* Coal tar enamel binders with an aromatic content in excess of 90%, show excellent water resistance in all tests while less aromatic materials show comparably poorer performance. Materials high in paraffinic content have been shown to leach under extended immersion.

* * *

An audio-visual meeting presentation discussing this important subject in detail is available. If you are interested in having a group-showing of this material—which includes a sound film—please address your inquiries to "How Long Should A Pipeline Last?," Koppers Bldg., Pittsburgh 19, Pa. or to Koppers District Offices: Boston, Chicago, Los Angeles, New York, Pittsburgh and Woodward, Ala. In Canada: Koppers Products, Ltd., Toronto, Ontario, and Edmonton, Alberta.

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COATINGS AND ENAMELS

(*Continued from page* 116)

coatings was determined by use of an improved GE Flexibility Tester. In this test the panel is bent around a conical mandrel so the coating is subjected to varying degrees of elongation, the most intense occurring at the smallest radius of curvature. Flexibility ratings ranged from No. 10, if no cracking or other coating failure occurred, to No. 1, if failure occurred entirely across a panel bent around the large-diameter end of the mandrel, and No. 10 if the coating fell off the entire large-diameter end (*Fig. 4 right*). Panels coated to a thickness of 5 mils on one side were tested at room temperature and at 15°F. A significant difference between the room temperature and 15°F ratings was obtained for some materials.

The *impact resistance* was determined by dropping a shaped weight from various heights onto a rounded tool resting on the back of a coated panel, and was reported as the smallest number of inch-pounds of impact required to cause a break in the coating film. In order to obtain additional qualitative information on the adhesion and plasticity of the materials tested, panels coated to a thickness of 5 mils on one side with each material were subjected to a reverse impact of 75 inch-pounds, and the type and extent of failure was noted. Three of the various types of results obtained in this latter test are shown in *Fig. 5*. The impact resistance of one neoprene material tested was greater than 150 inch-pounds, and the resistances of the remaining materials ranged from 4 to 50 inch-pounds. This test was run on panels at 15°F and room temperature, and significant differences were obtained in some instances.

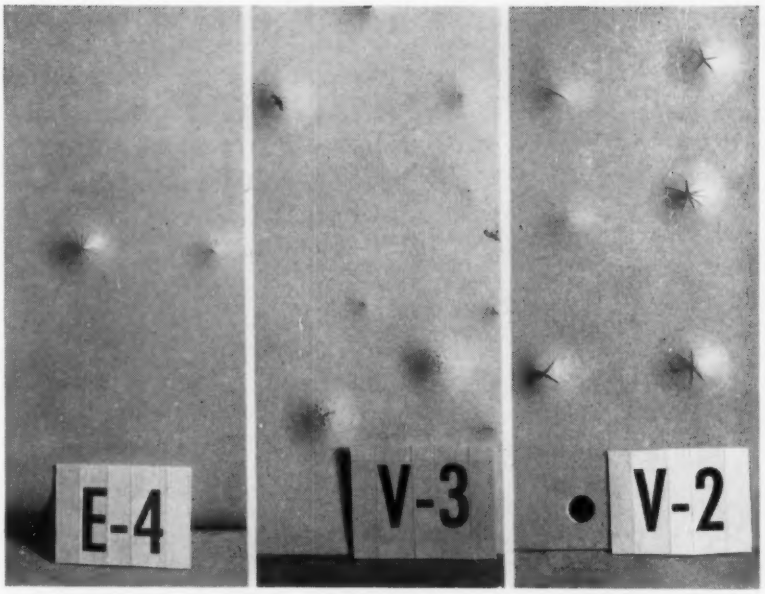

Fig. 5. Three types of failure produced by 75-in.-lb. impact test.

Summary

It is anticipated that the laboratory evaluation described in this article will serve to determine which of the types of coating materials tested have properties most suitable for use as an internal pipe coating for various types of natural gas service. These test results will also constitute a standard against which the properties of other coating formulations can be compared to screen their suitability as an interior pipe coating.

Several questions in regard to internal coating of pipe for natural gas service require further investigation. One of the most controversial is whether significant improvement of flow efficiency can be obtained by internally coating large diameter gas transmission lines. This question can be resolved only by careful and extensive field tests of the flow efficiency of internally coated transmission piping by use of precise test procedures.[2]

The application of certain materials that have suitable properties for use as an internal pipe coating may not prove practicable under field conditions. The conditions encountered in the field application of coating materials are not ideal, since temperature and humidity cannot be controlled, and the pipe surface will invariably be contaminated to a certain extent with rust and mill scale. Laboratory-scale tests may be desirable to determine the effect of varying surface contamination, and temperature and humidity conditions during application, on the properties of the types of coating materials selected as most promising on the basis of the laboratory evaluation tests.

The service life of an interior coating in natural gas pipeline service is most important and can only be determined on the basis of service experience. It should also be determined whether a coating material applied to the interior of a natural gas pipeline will ultimately fail in a manner detrimental to the operation of the pipeline. One comment that can be made in regard to the ultimate failure of coatings in service is that it is highly desirable that any particulate matter produced should be finely divided. It is anticipated that a coating material whose adhesion is greater than its cohesion will produce only finely divided particles at failure, whereas materials which have considerably greater cohesion than adhesion will tend to produce strips and sheets of matter at failure. ■

ACKNOWLEDGEMENT

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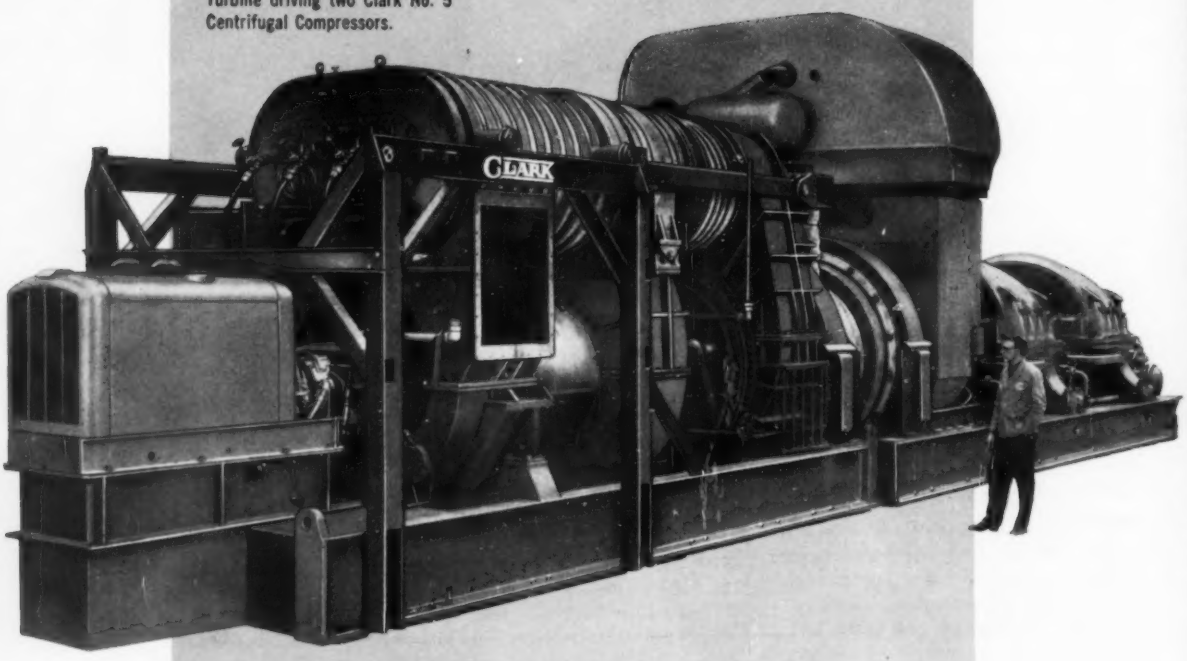
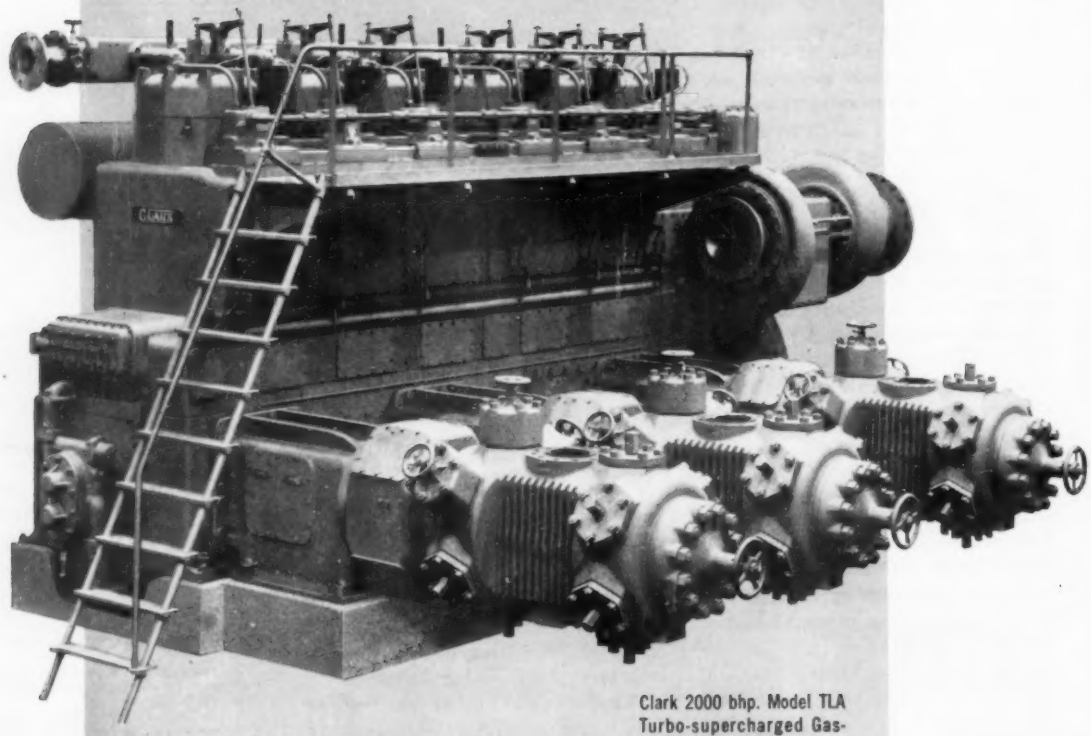
Clark 8500 bhp. Model 302 Gas Turbine driving two Clark No. 5 Centrifugal Compressors.





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GAS pipeline news

CIG faces bankruptcy, says President Mueller

If Colorado Interstate Gas Co. must comply with a recent FPC ruling, the company faces bankruptcy, President W. E. Mueller says.

A commission presiding examiner has filed a decision, subject to review by the commission, disallowing in substantial part two proposed rate increases, together totaling nearly $20 million.

Applying the recommended rates on 1956 volume, Mr. Mueller said, shows that his company would have made only half enough money to pay interest on its bonds. No money would have been available to pay dividends on either preferred or common stock.

The examiner's recommendations raised serious questions about planned long range financing, according to Mr. Mueller. CIG has proposed a major expansion of pipelines and other gas supply facilities, dependent in part on long-term financing.

J. P. Roetzel, CIG financial vice president, said the recommended rate structure would amount to "confiscation."

They Go Together...

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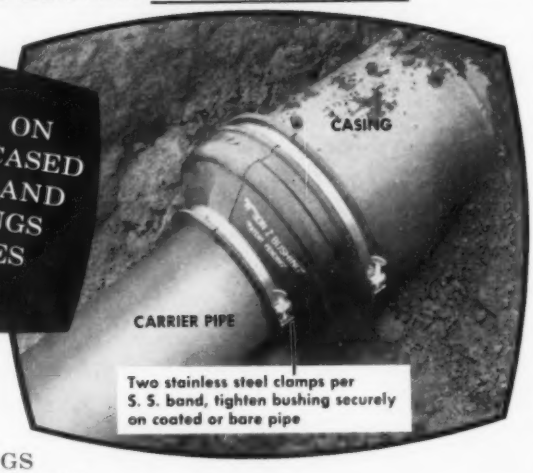
*INSTALLED ON EXISTING CASED CROSSINGS AND SPLIT CASINGS ON PIPELINES IN SERVICE



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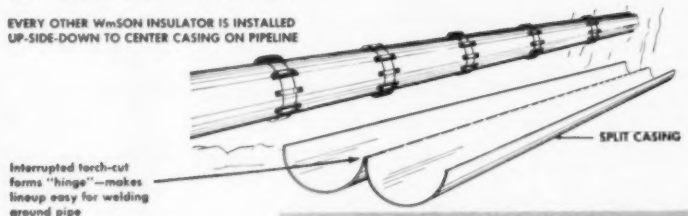
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SPLIT CASING
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El Paso seeking Canadian reserves

Steps are being taken by El Paso (Texas) Natural Gas Co. to obtain additional Canadian reserves in Alberta's Savanna Creek field. This area is reportedly capable of producing an estimated 150 MMcf of gas a day for about 20 years.

El Paso's Paul Kayser reports that El Paso has agreed to purchase $3 million of common stock of Canadian Husky Oil Ltd. and to advance $2 million for development of acreage that Husky has in the Savanna Creek area.

Husky owns approximately one-third of the field, and has agreed to contract with Westcoast Transmission Co. Ltd. for sale of gas it will produce there. Westcoast already holds a contract with Phillips Petroleum Co. for another one-third of such gas, Mr. Kayser said. He expressed the expectation that owners of the remaining interest in the field will execute a similar contract in the near future.

Canadian gas for Midwest up for decision soon

End of the drawn-out battle before the Federal Power Commission over who, if anyone, should be permitted to import natural gas from Canada into the Midwest may finally be in sight.

Hearings on the final fact-finding phase of the hearing opened before FPC Examiner Francis N. Hall in May and he predicted then that they should grind to a close "in about three months"—or about the middle of August.

Chances are that it will take the examiner some time to reach a decision on whether to approve

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the application of Midwestern Gas Transmission Co., an affiliate of Tennessee Gas Transmission Co., to run a line from a Canadian border tie-in with the Trans-Canada pipeline to Tennessee, or to approve competing applications to serve the north central states.

Whatever the examiner decides in the case is certain to be protested, and the full commission's final decision is likely to wind up in a series of long court battles.

The controversy has now been nicknamed the "four companies" case after the FPC consolidated the Midwestern application with three other firms who are opposing the project and seeking to build new facilities of their own in the northern areas which Midwestern would serve.

These three are Northern Natural Gas Co., Michigan-Wisconsin Pipe Line Co., and Natural Gas Pipeline Co. of America, a ranch of the People Gas system of Chicago.

Some 93 other gas firms, cities, pipelines, and coal interests have entered the case as intervenors. Hearings started about a year ago, and have produced literally mountains of testimony.

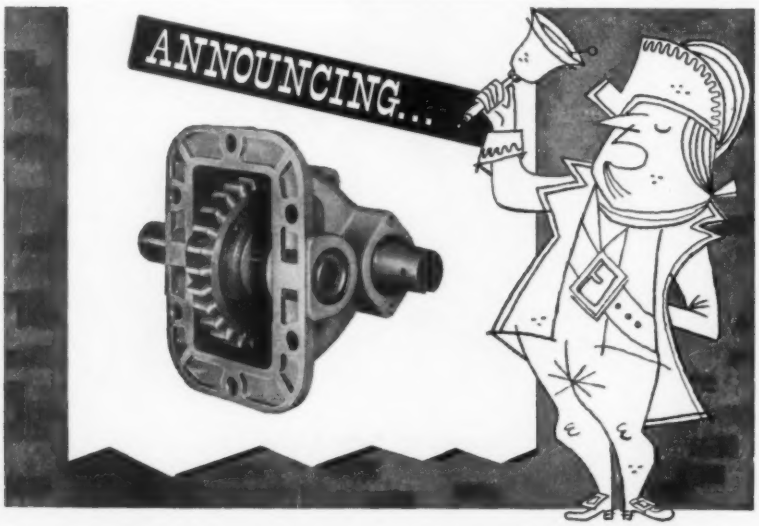
Opponents of the Midwestern plan claim the company would be "invading" markets now served by other firms, and are opposing the importation of natural gas from Canada as an unsound and unregulated source of supply.

New Cooper-Bessemer service and parts warehouse facilities at Casper, Wyo., serve the Wyoming, Colorado, Utah, and Montana area. Owen Lawrence, field service engineer, is directing the new facility.

More eastern shore service proposed

Consolidated hearings are under way on expansion proposals of Transcontinental Gas Pipe Line Corp., Houston, and Eastern Shore Natural Gas Co., Salisbury, Md. (Dockets G-12059 and 12200).

Transco wants to spend $61.5 million for 57 miles of mainline pipe in Louisiana, Mississippi, Alabama, Georgia and South Carolina; 225 miles of purchase laterals in Texas and Louisiana; 81,820 hp in new compressor stations in Louisiana, Mississippi, Alabama, Georgia, North Carolina and



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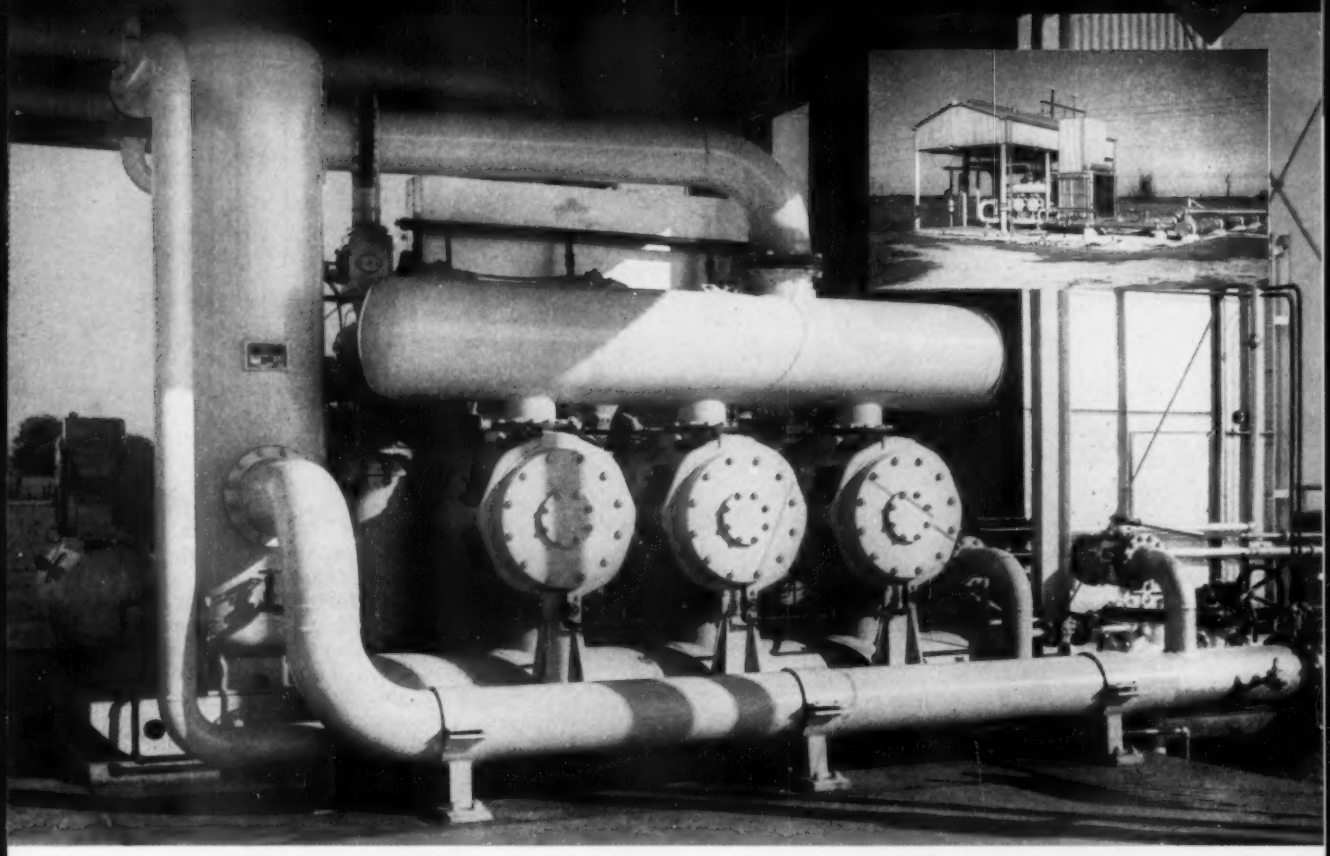

UNITED GAS PIPELINE COMPANY'S Monroe Field Station No. 1 equipped with a Beaird-Ingersoll-Rand 6SVG 330 h. p. packaged compressor complete with all necessary controls for unattended operation. Other sizes from 120 to 660 h. p.

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LOWEST COST PER HORSEPOWER INSTALLED

UNITED GAS PIPELINE COMPANY has installed this Compressor Station near Sterlington, Louisiana. Equipped with a Beaird-Ingersoll-Rand 6SVG 330 h.p. packaged compressor, the station is an integral part of United's Monroe Field facilities. Gas from declining wells in the field are boosted from 10 psig to main line pressure of 25 psig. Ten million cubic feet per day are handled by this single Beaird unit.

Designed for unattended operation, the compressor is equipped with regulators that enable the driving engine to throttle from half to full speed to maintain constant discharge pressure. Should operating conditions become less stable, compressor valve unloaders can be installed which will provide completely automatic operating control. The compressor will then unload its cylinders in steps, maintaining precision discharge pressure to the main line. When the condition causing the pressure build-up is eliminated, the unit would automatically close the unloading valves and pick up the required load.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your special requirements.

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pipeline news • *Cont'd.*

Virginia; 38,140 additional hp in existing stations in Georgia, South and North Carolina, Virginia, Pennsylvania, Louisiana, and Texas; seven distribution meter stations in Pennsylvania and Virginia; five gathering meter stations and five dehydration stations in Texas; and additional facilities at existing compressor stations.

Transco will use the new facilities to increase service to 16 existing customers and initiate service to four new customers. The new customers and their daily requirements are: Atlantic Seaboard Corp., Charleston, W. Va., 25 MMcf; Virginia Electric & Power Co., Richmond (transportation service), 25.5 MMcf; Eastern Shore, 5 MMcf; and Central Virginia Gas Co., Orange, Va., 1.3 MMcf.

Eastern Shore proposes to construct and operate approximately 124 miles of 8⅝- and 6⅝-in. transmission line and other facilities to serve the eastern shore areas of Delaware and Maryland at a cost of approximately $3 million.

In addition to its own gas, Eastern Shore proposes to transport for the account of Delaware Power & Light Co. 4 MMcf/day additional gas to be bought by Delaware Power from Transco.

El Paso-Permian deal balances gas take

Under terms of a new contract, Permian Basin Pipeline Co., Omaha, will sell up to 200 MMcf/day of gas to El Paso (Texas) Natural Gas Co.

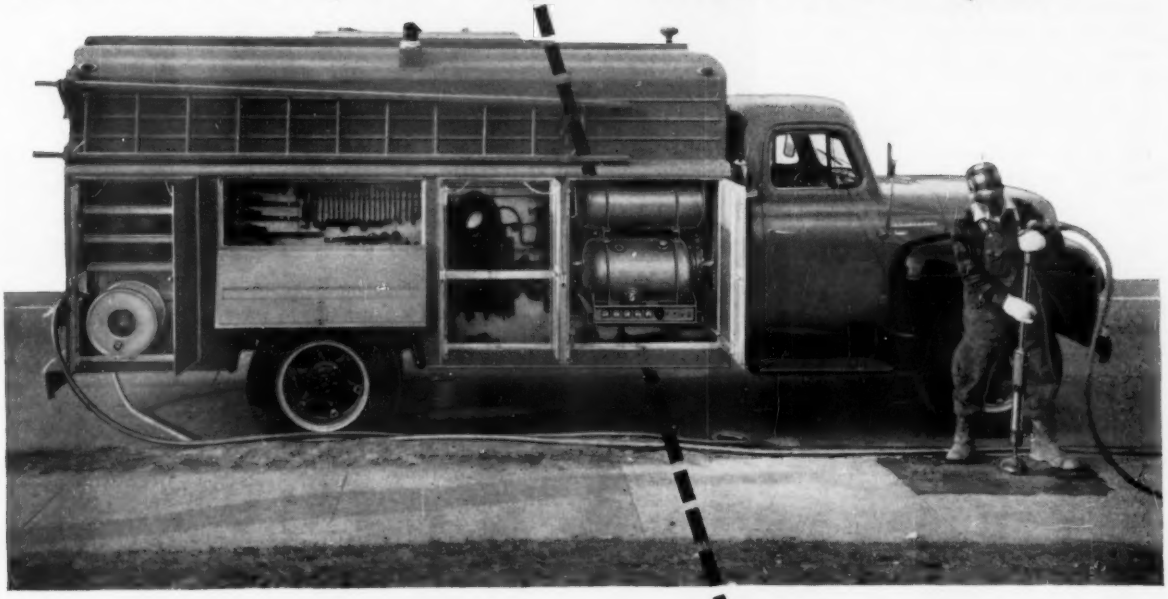
The gas will be produced in Lea county, N. M., and the sale is expected to continue through 1958 and thereafter so long as the market situation of the two companies makes such continuation desirable. The proposed sale must have FPC approval.

Turbodrill field tests successful, says Dresser

A progress report on Dresser Industries' Turbodrill units shows that the unit is a satisfactory, powerful "down-hole" drilling engine, suitable for oilfield use, and operates in a "trouble-free" manner.

Major oilwell drilling contractors and major operating companies have been field-testing 40

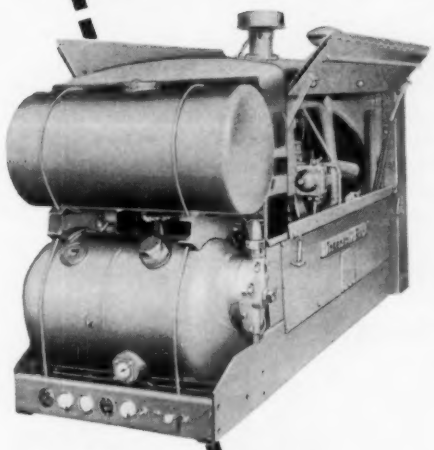
ROOM to spare POWER to spare



Here's a rotary air compressor that's so small and compact you can mount it in a Utility truck and still have plenty of room for men and equipment. And with a full 125 cfm capacity, you have plenty of air power for all normal digging, demolition and tamping jobs, too.

The Ingersoll-Rand GRU-125 GYRO-FLO compressor occupies only 70 cubic feet of space and weighs only 2000 pounds. Designed especially for truck mounting, this completely self-contained, self-powered unit can be located crosswise behind the cab, taking up only 31" of truck length and 46½" of the height. The control panel, for ease of operation, is mounted below the receiver at the curb side of the truck.

What's more, the GRU-125 has proven itself in over three years of service with utility companies all over the country, It also offers all the *service-proved advantages* of the famous GYRO-FLO portable rotary compressor. No pistons, rods, valves or clutch to wear out or adjust; discharge temperatures less than 200F; low oil consumption and smooth, vibration-free operation. *Yes, there's only one* GYRO-FLO—Ingersoll-Rand's rotary portable compressor. It will pay you to ask your I-R representative for complete details.



with the GRU-125 utility

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Turbodrills for the past six months. Otto Hammer, Dresser Industries' operating vice president and general manager of the Turbodrill division, reports that field tests have also proved that when using the Turbodrills, drilling bit penetration rates definitely can be increased. Under certain drilling conditions, conventional "off-the-shelf" rock bits are capable of transmitting the Turbodrill's higher speed and horsepower with full success. Likewise, when the Turbodrill is used for hole-opening operations, drillstring (pipe) vibration is reduced considerably and higher bit weights can be used.

Moving Turbodrills onto the rig floor requires the same handling procedure as that used for drill collars, as is seen here in shot made near Odessa, Texas, where the Turbodrill is now being run.

Drilling tests are being continued, and intense research is under way both here and abroad to develop tougher drilling bits that can really operate continuously at peak efficiency under the tremendous power of the Turbodrill.

New pipe coating plant serves southeastern area

A major pipe coating and wrapping plant has been opened in Doraville, an Atlanta, Ga., suburb.

Features of the new Southern Pipe Coating Co. plant are its completely automatic handling of pipe to insure top quality coating and wrapping. The plant, located on a 17-acre site, is designed to process 12 miles of pipe a day. Eventually, the plant will be on a three-shift, 24-hour-a-day operating schedule.

In addition to the automatic handling equipment, Southern Pipe Coating's facilities include a double holiday detection test.

J. C. Matthews heads up the sales offices of Southern Pipe Coating in Atlanta. He was formerly with the Barrett division of Allied Chemical & Dye Corp.

Storage pool to be activated by N. Y. Natural

Approximately 35 billion cu ft of gas will ultimately be stored by New York State Natural Gas

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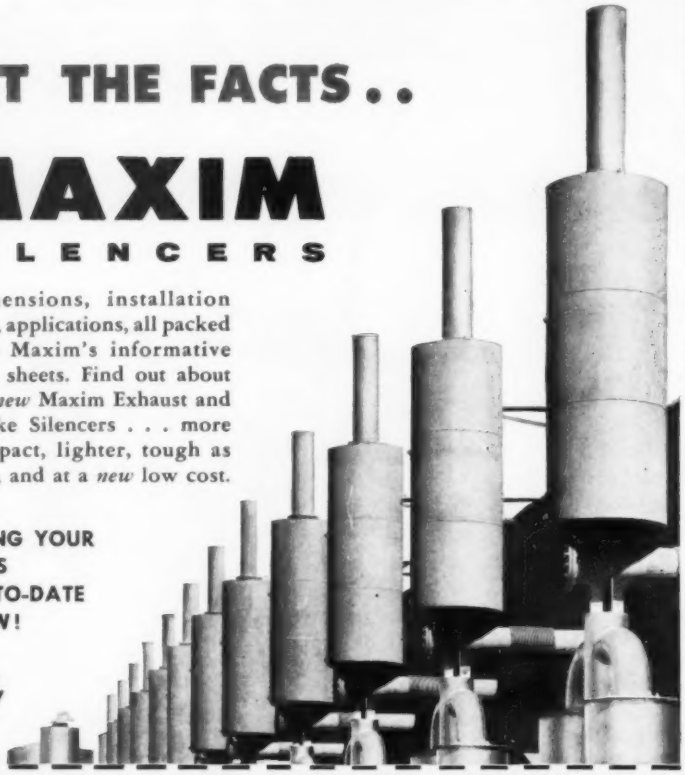

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Corp. in an underground natural gas storage pool recently approved by the FPC (Docket G-11779). Authorization for 45.6 miles of line in Steuben county and in Potter and Tioga counties, Penna., was also received.

Movement of gas in a well isn't transporting gas

Continental Oil Co.'s application to the FPC seeking authorization for the sale of natural gas has been dismissed by a presiding examiner for want of jurisdiction under the provisions of the Natural Gas Act.

Presiding Examiner Emery J. Woodall ruled that the sale of gas by Continental to El Paso (Texas) Natural Gas Co. from a single well in the Langmat field, Lea county, N. M., is a sale of gas in place in the well and not a sale in interstate commerce.

Continental was the only party to introduce evidence, and this went undisputed. The FPC staff contended that since the sale is made by the producers to an interstate pipeline company for resale, the producer is engaged in interstate transportation. The facilities owned by Continental, in addition to the pipe in the well below, are the casinghead, a bleeder valve, two master valves and their connections. Delivery takes place at the point where the facilities owned by Continental end and the facilities owned by El Paso begin. This is at the point where the gas enters the 4-in.x2-in. reducing swage at the top of the Christmas tree.

The presiding examiner said the "well owner is physically incapable of producing gas from the well . . . because his facilities . . . are incapable of controlling the flow of the well."

El Paso, not Continental, produces the gas from the well, he said. "The gas sold by the contract," Examiner Woodall added, "was not gas in motion. The first movement . . . occurred when El Paso installed (and operated its) facilities to allow the flow of gas from the well at its well pressure at the rate determined by El Paso's valve manifold."

The examiner concluded that no provision of the Natural Gas Act required Continental to obtain authorization for the drilling of a gas well, the installation of the well casing, the casinghead, the bleeder valve, the master valves or any of the facilities owned by Continental as part of the well involved.

"No case decided by any court," he said, "and no decision or order of the commission has been cited or found that requires the certification of the sale or of the facilities here involved . . . Movement of gas in a gas well is not transportation of gas."

Automatic Electric move is four-month task

The four-month move from Chicago to Northlake, Ill. is under way by American Electric Co. According to the National Furniture Warehousemen's Association and the Movers' Association of Chicago, this is the largest move ever undertaken in the Midwest.

Leslie H. Warner, president of Automatic Electric and chief executive officer of the manufacturing, sales and research division of the General Telephone System, emphasized that the move has been

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Multiple small-diameter cyclone tubes create a high centrifugal force, resulting in the removal of solids and liquids without the use of wetting agents. The result is a dry, clean product.

This principle assures high efficiency, and continuous discharge of contaminants with no pressure build-up.

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planned so that production will not be interrupted. Various departments will be moved in reverse production line order. A fleet of trucks will be kept in almost constant service to shuttle parts from departments still operating at the old location to departments already moved to the new facilities.

Mr. Warner says that Automatic will double production once settled down in the new plant.

The new Automatic plant stands on a 167-acre site. The building, one of the largest industrial structures in the Middle West, will house the General Telephone Laboratories and the general offices and United States production facilities of Automatic Electric.

FPC accepts Panhandle's refund statement

Panhandle Esatern Pipe Line Co.'s statement of refunds has been accepted by the FPC (Docket G-1116 et al.).

The acceptance covers additional refunds totaling $540,000, including principal and interest, to its wholesale customers in the Midwest. This brings the total refunds to $40,014,300.

Montana-Dakota adding to system in 3-state area

Montana-Dakota Utilities Co., Minneapolis, has received FPC authorization for several construction projects in North Dakota, Montana, and Wyoming.

Under Docket G-12329, the company will install a 1980-hp compressor station at Dickinson, N. D.; 6 miles of 12¾-in. transmission line between Mandan and Bismarck, N. D.; new regulating stations to serve Bismarck and Mandan; 4640 ft of 6⅝-in. lateral line near Sidney, Mont., to provide emergency gas service to Montana-Dakota's 44,000 kilowatt steam electric generating plant now under construction; a regulating station to serve the generating plant; and metering and appurtenant facilities to the company's existing desulfurization and dehydration plant in the Garland field, Big Horn county, Wyo. These facilities will cost Montana-Dakota slightly over $1 million.

In Docket G-10521, the FPC has authorized the company to construct and operate facilities in Montana at a cost of $1 million.

Included are 28.3 miles of 12¾-in. mainline pipe from Fallon county to Dawson county; a 660-hp compressor unit at its Cabin Creek station; new cooling facilities for the entire plant; and two 540-hp compressor units and related facilities in its existing Baker compressor station.

Southern Natural may acquire oil refinery

Southern Natural Gas Co., Birmingham, is negotiating for the purchase of the assets of Suntide Refining Co.

According to reports, negotiations involve $36.7 million.

Suntide operates a refinery northwest of Corpus Christi with a capacity of 75,000 bbl of crude oil daily.

If the purchase is completed, Southern may form a wholly owned subsidiary to operate the refinery, it is reported. Southern Union has recently undertaken exploration in Venezuela.

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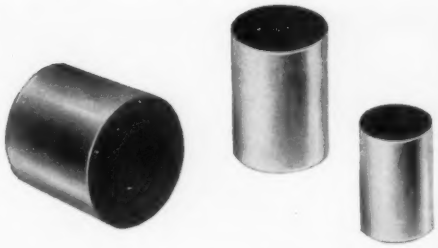

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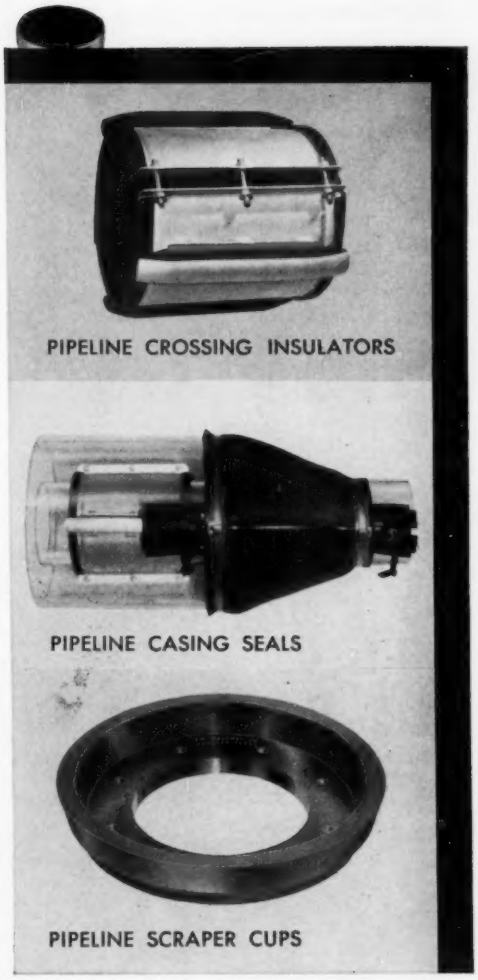

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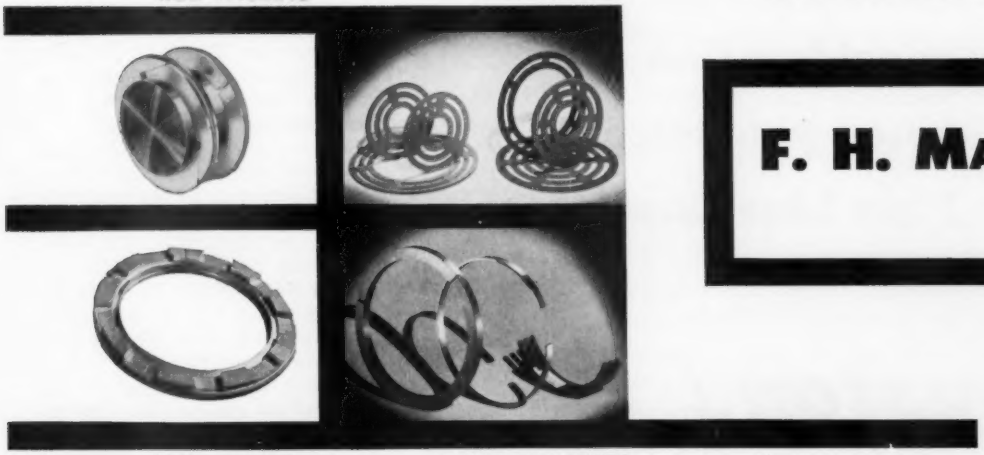

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LOS ANGELES
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"Precision In Rubber, Metal and Plastics"

Pipe shortage slows Mississippi expansion

A shortage of pipe has forced Mississippi River Fuel Corp. to amend its $11.6 million construction plan.

The St. Louis company has withdrawn its FPC application for a 50 MMcf/day increase in pipeline capacity, and has filed a new application to boost capacity 10 MMcf. Richard W. Horner, vice president, said the company expects to file applications for additional increases in capacity as pipe becomes available.

IPAA's Russell Brown (left) conversed with Reps. Harris and O'Hara (right) before hearings on their natural gas bill got under way.

2-year Provo production: 2500 miles of steel pipe

More than 2500 miles of large and small diameter steel pipe have rolled from the Utah pipe mill of Consolidated Western Steel Division since the plant commenced operations two years ago.

In reporting on the Provo plant, Charles W. Lee, president of this U. S. Steel division, predicted for the balance of 1957 a continued high level of operations for the pipe industry in general and for the Provo plant, where pipe from 4 to 36 in. in diameter is manufactured.

Rebate bill passed by Texas senate

Legislation calling for rebates totaling almost $6 million paid under the outlawed Texas gathering tax has been approved by the Texas senate.

However, the bill provides that almost $5 million of the money will be applied as a credit against state taxes to be paid in the future by the companies. The companies and their tax credits are El Paso Natural Gas Co., $2,658,935; Tennessee Gas Transmission Co., $1,140,906; and United Gas Pipe Line Co., $1,101,000.

Actually, 49 companies are involved in the rebate bill. The total rebate for 46 companies, to be paid in cash, amounts to $842,633. The remaining $4.9 million is earmarked for the tax credits.

Dependability

an important consideration when you select a Pipe Line Contractor

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HOW BELL SYSTEM COMMUNICATIONS SERVE THE PIPELINE INDUSTRY

CARROLL V. KROEGER, *distribution engineer, Washington Natural Gas Company, Seattle, Wash.*

"How we know when to interrupt our interruptibles"

Remote metering lines give Washington Natural Gas a 24-hour headstart on determining contract demand

"To stay on the profitable side of our contract, we need continuous readings of flow to determine customer demand—the difference between flow measured at city gates, and supply to our interruptibles," says C. V. Kroeger, Washington Natural Gas.

"Bell System remote metering lines give us these readings. Here in our Seattle office, meter readings from 75 remote points enable us to calculate flow at all gates and project demand over the next 24 hours. Thus we know when to interrupt our interruptibles—or tap our 'peak shaving' reserve.

"Why do we lease lines from the Bell System? For one thing, the service is economical—no capital investment is needed. And telephone men maintain the lines, so we don't have to train new men for our staff. But mainly, Bell service is reliable. We know we can count on it."

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A Bell System representative will gladly study your communication needs—at no cost, of course—to show how you can get these benefits. Just call your local Bell Telephone Company business office.

BELL TELEPHONE SYSTEM

PRIVATE LINE TELEPHONE • PRIVATE LINE TELETYPEWRITER • DATA TRANSMISSION SYSTEMS
CHANNELS FOR: REMOTE METERING AND CONTROL • TELEPHOTOGRAPH • CLOSED CIRCUIT TV

pipeline news • *Cont'd.*

Storage facilities okayed for Natural Gas Storage

Natural Gas Storage Co. of Illinois, a Peoples Gas subsidiary, has FPC permission to convert a gas field into an underground gas storage reservoir at a cost of $3.7 million.

Construction of the Cooks Mills storage field project, located south of Arcola, Ill., consists of a compressor station, dehydration plant, and meter station.

Work progressing on Trans-Canada line

Construction is under way on the western section of the Trans-Canada Pipe Lines line from the Alberta-Saskatchewan border to eastern Canada.

Mannix Ltd., Calgary, the contractor building Section 3 of the 34-incher, is working on all phases of construction. In order to speed up trenching while the frost still was in the ground, Mannix used a pilot ditching machine to cut the initial ditch about 4 ft deep. It was followed by two more ditchers cutting the ditch to the required 6 ft.

Other sections under way include the portion east of Regina and Sections 4, 5, 6 and 7 with Dutton-Williams Brothers Ltd., Price-Pool Ltd., Canadian Bechtel Ltd., and Majestic Contractors doing the work. From the Ontario border to Port Arthur, Ontario—the section being built by the Northern Ontario Pipe Line Crown Corp.—contracts have been let to Dutton-Williams Brothers Ltd., Morrison-Shivers Ltd., Majestic Contractors, and Houston Contracting Co.

Safety honors go to Price foremen

Four foremen of H. C. Price Co. field construction crews have won certificates of honor of the Joseph A. Holmes Safety Association. These new safety awards follow three others recently granted Price by the National Safety Council.

Citations were presented to R. W. Orr for no lost-time injuries in a 5-year period during which a total of 222,744 man-hours were worked; Joe Riley, for no lost-time injuries to members of his crews for a 4-year period during which 239,540 man-hours were worked; Elwood Roth, for supervising a pipeline construction crew without a lost-time injury for four years, for a total of 239,159 man-hours; and to Athel Bell, for supervising a pipeline construction crew without a lost-time injury for four years, with a total of 219,122 man-hours.

PIPE LINE HALF SOLES

SLEEVES

ON THE JOB CONSTRUCTION

CONCRETE RIVER WEIGHTS

One of the many Edwards Concrete River Weights installations on Texas-Illinois Natural Gas Pipeline.
Edwards Split Welding Sleeves also used on the line to insure perfect joints in swamps, rivers and safety zones.

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GAS pipeline notes

Thirty-seven miles of 24-in. loop have been authorized by the FPC on Ohio Fuel Gas Co.'s system. The loop, to cost about $2.8 million, will run northward from OFG's Crawford station in Fairfield county to Treat station in Licking county, Ohio. Ohio Fuel was also authorized (Docket G-11094) to construct and operate a tie-in for the 24-in. line at the Crawford station.

The Bristol Co., Waterbury, Conn., has opened a new branch factory and repair laboratory in Los Angeles, J. W. Peckham, who has been Bristol's West Coast district manager for many years, is managing the new facility.

Somerville Construction Co., Ada, Mich. has formed a subsidiary company in Peoria, Ill. The new subsidiary, Somerville-Illinois Co., will specialize in construction and maintenance of pipelines and distribution systems in the central states area. Joe Boyd has been named general manager with Neil VandeSchraaf as office manager.

Volume II of the "Federal Power Commission Reports" covering opinions, decisions, and orders of the FPC for 1952 has been issued. With the publication of the new volume, all opinions and decisions issued by the commission between Jan. 1, 1931 and Dec. 31, 1952, are available in report form. Copies are available from the FPC at $5.50 each. Order number is FPC A-53.

GAS progress reports

NEW CONSTRUCTION PLANNED

EASTERN SHORE NATURAL GAS CO., Salisbury, Md. Docket G-12200 for 124 miles of 8⅝-and 6⅝-in. line and appurtenant facilities to serve eastern shore areas of Maryland and Delaware.

IRON RANGES NATURAL GAS CO., St. Paul. Docket G-12217 to build 63 miles of transmission line on north shore of Lake Superior.

CURRENT CONSTRUCTION

ALBERTA GAS TRUNK LINE CO. LTD., to build 550-mile gathering line in Alberta. 1956 construction consisted of Red Deer river crossing near Bindloss.

CHICAGO DISTRICT PIPELINE CO., Joliet, Ill. Docket G-10549 for 14.1 miles of 36-in. line from terminus of existing Howard Street line in Elk Grove, Ill., to a point on northerly city limits of Chicago.

EL PASO (TEXAS) NATURAL GAS CO. Docket G-10481 to install 28.1 miles of 10¾-in. line in Nolan and Coke Counties Texas; install new 1320-hp compressor station at Jameson. Line completed. Work underway on compressor.

EL PASO (TEXAS) NATURAL GAS CO. Docket G-10499 to build 288 miles of field lines and mainline and 53,200 hp in compressor capacity in Texas, New Mexico, and Arizona in order to deliver 75 MMcf/day addition to SoCal and SoCounties Gas companies and 75 MMcf/day to Pacific Gas & Electric.

KANSAS-NEBRASKA NATURAL GAS CO., Hastings, Neb. Docket G-10014. The 32.7 miles of line authorized now nearly completed. The 11.5 miles of 12-in. and 1.2 miles of 6-in. already completed. Ten miles of 10-in. and 10 miles of 8-in. under construction by Brodie Construction Co.

MICHIGAN WISCONSIN PIPE LINE CO., Detroit. Docket G-2327 for 15.5 miles of 4- and 6-in. line to Three Rivers, Mich. completed. 25 miles of 24-in. in Wisconsin and 18.5 miles of 4-in. in Iowa, Illinois, Wisconsin and Michigan authorized and scheduled for completion this year. All other construction under this docket has been completed and is in operation.

MONTANA-DAKOTA UTILITIES CO., Minneapolis. Docket G-12329 for 4640 ft of 6⅝-in. line to Sidney, Mont. steam electric generating plant; 1980-hp compressor near Dickinson, N.D.; and 6.1 miles of 12¾-in. transmission line between Mandan and Bismarck, N.D.

MONTANA-DAKOTA UTILITIES CO., Minneapolis. Docket G-10521. Remaining compressors (two 540-hp at Baker, Mont.) scheduled for installation next summer.

MOUNTAIN FUEL SUPPLY CO., Salt Lake City. Dockets G-10426 and 10446. To build 38 miles of 20-in line and compressors to transport from Sweetwater county in southern Wyoming 60 MMcf/day purchased from Pacific Northwest Pipeline Corp. Also 2640 hp addition at existing compressor station. 5 miles line and compressors completed. Balance pending.

NORTHERN NATURAL GAS CO., Omaha. Docket G-112251 to increase capacity 149 MMcf/day, serve 213 additional communities. Construct approximately 365 miles of mainline additions, 1090 miles of branch lines, and 29 compressor station additions.

PACIFIC GAS & ELECTRIC CO., San Francisco. For 83-mile 20-, 18-, and 16-in. line from Beehive Bend field near Willows, Calif., to a point near Davis and then east into Sacramento. About 75 per cent complete.

SOUTHERN CALIFORNIA and SOUTHERN COUNTIES GAS CO., Los Angeles. A 241-mile 30-in. line from Newhall, Calif. to Colorado river near Needles to meet El Paso Natural line from San Juan and Permian basins. R. H. Fulton & Co., Lubbock, Texas, started construction in January. Completion scheduled for July 1957. Four 2000-hp compressors will be installed at new station near Needles. Peter Kiewit Sons' Co., Omaha, started construction in May. Schedule to begin operation in November.

TEXAS EASTERN TRANSMISSION CORP., Shreveport. Dockets G-2503, 9784-87. 422 miles of 30-in. line near Mexican border to transport gas to Texas Eastern's Vidor, Texas station; approximately 45 miles of 24-in. pipe connecting TET's existing line near Provident City, Texas, to the new line; pipeline loops totaling about 77 miles at various locations along existing 30-in. system; approximately 147 miles of supply and sales laterals; new and additional compression facilities totaling 32,250 hp; and approximately 20 sales measuring and regulating stations.

TRANS-CANADA PIPE LINES LTD., for 2287-mile gas line taking Alberta gas from Alberta - Saskatchewan border to Toronto and Montreal, with lateral from Winnipeg to Emerson, Man., 34-in. line from Alberta border to Winnipeg under construction. 30-in. from Winnipeg to Toronto; 24- and 20-in. from Toronto to Montreal; 24-in. from Winnipeg to Emerson; 10 compressor stations totaling 105,000 hp. First four sections of line under contract to Majestic Contractors Ltd., Mannix Ltd., Canadian Bechtel Ltd., and Dutton-Williams Brothers. Section 5, Price-Poole Ltd.; Section 6, Canadian Bechtel Ltd.; Section 7, Majestic Contractors Ltd. Sections 1 and 2 completed in 1956.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston. Docket G-10000. For 131 miles of 36-in. and 52 miles of 30-in. paralleling mainline through Louisiana, Mississippi, Alabama, Georgia, the Carolinas, Virginia, Maryland, and Pennsylvania. Project will increase deliveries to existing customers in New York-New Jersey area and add new customers in Piedmont area.

WESTCOAST TRANSMISSION CO. LTD., Calgary. To build 650-mile, 30-in. line from Peace river area to near Vancouver, B. C., to connect with line of Pacific Northwest Pipeline Corp., to transport 400 MMcf daily, of which 300 MMcf is to be delivered to PNW. 400 miles of line installed and ready for testing. Scheduled for completion in fall of 1957.

GAS pipeline people

VERN HORTE, former petroleum engineer with DeGolyer & MacNaughton, Dallas, has joined Trans-Canada Pipe Lines Ltd. in Calgary as chief gas supply engineer. He will head the geological and reservoir engineering work of Trans-Canada.

J. B. EATON JR. became superintendent of Texas Gas Transmission Corp.'s compressor station department on June 1. He succeeds J. RAY FISHER, who has retired. Mr. Eaton has been assistant superintendent for the past nine years. Mr Fisher, who will be available in a consulting capacity to Texas Gas, joined the company in 1949 as assistant chief engineer in charge of compressor station engineering and construction. He was made compressor superintendent in 1949.

G. P. BROCKMAN has been named chief engineer and W. E. FRYER is project engineer of Guy T. Martin & Co. Inc., Los Angeles. Both men were formerly associated with Richfield Oil Corp.

EUGENE L. MILLER has been elected president of Cooper-Bessemer Corp., Mt. Vernon, Ohio. At 38, Mr. Miller is the youngest president in the 124-year history of the company. He will retain his former post of general man-

J. B. Eaton Jr.
Texas Gas

J. Ray Fisher
Texas Gas

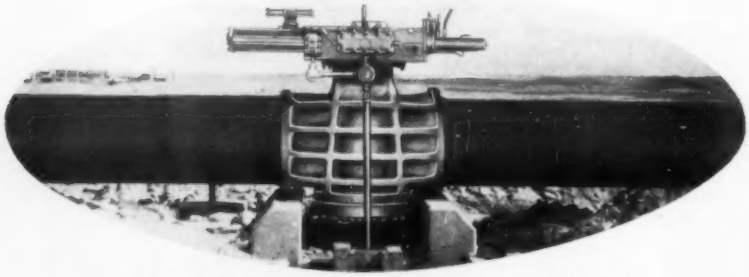
Verne Horte
Trans-Canada

G. P. Brockmann
Martin & Co.

Ledeen Gate Valve Operator with integral gas powered hydraulic oil system mounted on buried main line block valve.

Ledeen VALVE OPERATORS

FOR THE GAS INDUSTRY



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Whether you use gate or plug valves in your large gas lines, Ledeen has one of the most complete lines of operators and controls available for their automatic operation.

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E. L. Miller
Cooper

J. D. Bland
Texas Eastern

ager. Mr. Miller was named a project engineer at Cooper-Bessemer in 1946 and eight years later was appointed assistant general manager. He became general manager 18 months ago.

Several appointments have been announced by Cooper - Bessemer Corp., Mt. Vernon, Ill. ARTHUR ABEL JR. succeeds B. L. POTTER as district manager of the Tulsa office. Mr. Abel was formerly branch manager of the Odessa, Texas office. Mr. Potter recently completed his 44th year with the engine building industry. In 1947 he was elected to the post of vice president and Mid-Continent manager. The company has also appointed JOHN O. FIGHTER as a sales engineer for Cooper-Bessemer International, New York. T. L. FREEMAN has joined the Los Angeles district office sales and engineering staff.

JOHN S. IVY, Houston, is a new member of the board of directors of Texas Eastern Transmission Corp., Shreveport. He fills the post vacated by George T. Naff, who has retired. Texas Eastern has also elected J. E. BIXBY to the post of treasurer. He has been with the company since January 1956, when he joined Texas Eastern as assistant treasurer. J. D. BLAND has been promoted to general superintendent of the petroleum products division of the company. He has been with Texas Eastern since Triangle Pipeline Co. became a part of the parent company in 1955.

John Ivy
Texas Eastern

J. E. Bixby
Texas Eastern

Youngstown's "big 5"

HELP SOLVE YOUR OIL OR GAS LINE PROBLEMS, WHEREVER YOU ARE

Here are the "Big 5" reasons why Youngstown Electric Weld Line Pipe is your best buy:

1. It bends readily
2. Wall thickness is uniform
3. Line up characteristics are excellent
4. Weldability is outstanding
5. Long lengths save you time and trouble

It's no secret that installation crews prefer Youngstown Electric Weld Line Pipe for its easy line-up qualities. Good line-up is a direct result of the extra care that goes into its manufacture. To achieve the optimum in roundness, each length of Youngstown Pipe is placed in an hydrostatic expander, here, internal water pressure forces the pipe out against the solid steel walls of the mantle. The diameter of the pipe is thereby increased to a uniformly accurate size. Every length conforms to specifications—ends are truly round, uniform in wall thickness, squarely cut and properly beveled for welding. These excellent line-up characteristics are more evidence that it pays to specify Youngstown Electric Weld line pipe.

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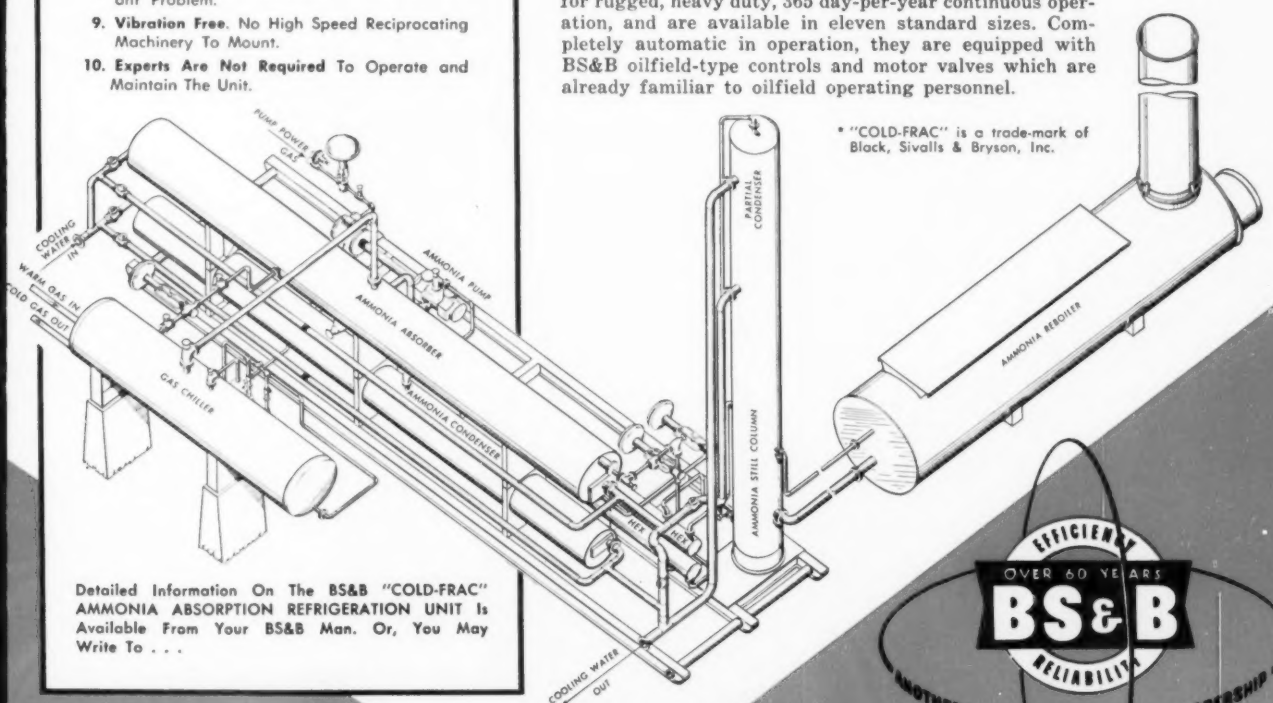

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